Cornell University

ANNOUNCEMENTS

Graduate School

1966-67

Calendar

FALL TERM	1965–66	1966–67
Registration (new students, first day)	Sept. 20–21	Sept. 19–20
Instruction begins at 1 p.m.	Sept. 22	Sept. 21
Language examinations, French, German and Russian	*(To be announced)*	*(To be announced)*
Last day for filing statement-of-courses form and change-of-committee form and for new students to file candidacy forms	Oct. 8	Oct. 7
Last day for taking qualifying and language examinations other than French, German, or Russian in order to have them considered as of the beginning of the term	Nov. 1	Nov. 1
Last day for change-of-course registration	Nov. 19	Nov. 18
Thanksgiving recess: Instruction ends, 12:50 p.m.	Nov. 24	Nov. 23
Instruction resumes at 8:00 a.m.	Nov. 29	Nov. 28
Christmas recess: Instruction ends, 12:50 p.m.	Dec. 18	Dec. 21
Instruction resumes at 8:00 a.m.	Jan. 3	Jan. 5
Last day for completing all requirements for February degrees	Jan. 14	Jan. 13
Term ends	Feb. 2	Feb. 1

SPRING TERM		
Registration for students in residence	Jan. 24	Jan. 23
Registration for new and readmitted students	Feb. 5	Feb. 4
Instruction begins at 8:00 a.m.	Feb. 7	Feb. 6
Last day for filing fellowship and scholarship applications for the following year	Feb. 8	Feb. 8
Language examinations, French, German, and Russian	*(To be announced)*	*(To be announced)*
Last day for filing statement-of-courses form and change-of-committee form and for new students to file candidacy forms	Feb. 18	Feb. 17
Last day for taking qualifying and language examinations other than French, German, or Russian to have them considered as of the beginning of the term	Mar. 1	Mar. 1
Spring recess: Instruction ends, 12:50 p.m.	Mar. 26	Mar. 25
Instruction resumes at 8:00 a.m.	Apr. 4	Apr. 3
Last day for change-of-course registration	Apr. 15	Apr. 14
Last day for completing all requirements for June degrees	May 27	May 26
Term ends	June 7	June 6
Commencement (conferral date for June degrees)	June 13	June 12

SUMMER		
Summer Research period begins	June 8	June 7
Registration for Summer School	June 29	June 28
Last day for filing statement-of-courses form and change-of-committee form and for new students to file candidacy forms	July 8	July 7
Language examination, French, German and Russian	*(To be announced)*	*(To be announced)*
Summer School ends	Aug. 12	Aug. 11
Last day for completing all requirements for September degrees	Sept. 2	*(To be announced)*
Summer Research period ends	Sept. 16	*(To be announced)*

The dates of University recesses are tentative.

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CORNELL UNIVERSITY ANNOUNCEMENTS

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ADMINISTRATION

James A. Perkins, A.B., Ph.D., President of the University
W. Donald Cooke, B.S., M.S., Ph.D., Dean of the Graduate School
Frederick S. Erdman, B.S., B.S. in M.E., M.M.E., Ph.D., Associate Dean of the Graduate School
John E. Deitrick, B.S., M.D., Associate Dean of the Graduate School of Medical Sciences
Jean-Jacques Demorest, B.A., M.A., License-ès-Lettres, Ph.D., Secretary of the Graduate Faculty

GENERAL COMMITTEE

Professor Charles F. Hockett, at large, term expires 1967
Professor Harry Levin, at large, 1967
Professor J. M. Echols, at large, 1965
Professor Isaac Rabinowitz (Humanities), 1967
Professor Stephen M. Parrish (Humanities), 1965
Professor Philip J. McCarthy (Social Sciences), 1967
Professor W. W. Lambert (Social Sciences), 1965
Professor J. Thomas Reid (Biological Sciences), 1967
Professor Lemuel D. Wright (Biological Sciences), 1965
Professor Robert A. Plane (Physical Sciences), 1967
Professor M. H. Cohen (Physical Sciences), 1965

The Secretary of the Graduate Faculty, ex officio
The Associate Dean, ex officio
The Dean, Chairman ex officio

The business office of the Graduate School and the office of the Dean are in Sage Graduate Center. Office hours are 8:30 a.m. to 4:30 p.m. Monday through Friday, and 8:30 a.m. to noon on Saturday (except during the summer).

Cornell University

THE GRADUATE SCHOOL

The Graduate School offers its students facilities for advanced study and research and assists them in obtaining a comprehensive view of a field of knowledge together with the training required for independent investigation. It encourages them to associate freely with mature scholars who will give them the aid and direction they need. It expects to attain its ends less through imposing an elaborate system of requirements than through developing a sense of responsibility for the advancement and wise application of knowledge.

The Graduate School has jurisdiction over all graduate work and any degree beyond the first degree given by any college or school. The Graduate Faculty is composed of those members of the thirteen special faculties who take an important part in the direction of graduate students working toward the advanced general degrees of the University. The Graduate Faculty is divided according to the 80 Fields listed and described on pages 53 to 144, under the four traditional areas of study — Humanities, Social Sciences, Biological Sciences, and Physical Sciences. The faculty members who choose to represent a Field may come from several colleges and departments. Following the name of each Field, the colleges represented by the faculty are indicated in parentheses. A third of the Fields are to some degree interdisciplinary in nature, and Graduate

Faculty members may serve as representatives of more than one Field. The faculty members appropriate to each Field are named at the beginning of the Field descriptions. One member of each Field serves as its Representative in carrying on its general correspondence and in communicating with the Graduate School Office.

In the administration of the three general degrees (Doctor of Philosophy, Master of Science, and Master of Arts), it is the intent of the Graduate Faculty to provide maximum flexibility of opportunity for the development of programs of study specific to the needs of the individual student. These three general degree programs are the main educational activity of the Graduate School. The advanced general degrees of Ph.D. and M.S. are also granted for graduate study pursued on the New York City campus of Cornell University. However, because of the problems created by distance, the full responsibility for the administration of the general degrees in New York City has been conferred by the Bylaws of the University upon the Faculty of the Graduate School of Medical Sciences, which is described on page 145.

In addition to the general degree programs, the Graduate School has responsibility for a number of professional Master's and Doctor's degree programs which are described briefly on pages 145 to 149. The details of administration of these professional degree programs are delegated to Divisions of the Graduate School. Because of their more specific objectives, the professional degree programs tend to be more closely defined in terms of formal requirements than is typical of the general degree programs.

The responsibility for administration of policies and procedures, including the general requirements, the establishment of Fields and subjects for study, admissions, and maintenance of records is placed in the hands of the Dean and his staff under the guidance of the General Committee of the Graduate School. These matters are described in detail in *The Code of Legislation,* copies of which may be obtained from the Graduate School Office by enrolled students and which are available for consultation in academic and administrative offices of the University.

ADMISSION AND REGISTRATION

APPLICATIONS

To be considered for admission to the Graduate School an applicant must (1) hold a baccalaureate degree granted by a faculty or university of recognized standing and/or have completed studies equivalent to those required for a baccalaureate degree at Cornell, (2) have adequate preparation for graduate study in his chosen Field of instruction, (3) have fluent command of the English language, and (4) present evidence of promise in advanced study and research. Students from United States colleges and universities should be in at least the top one-third of their graduating class.

Applications for admission are to be made on special forms which will be forwarded to inquirers who request them from the Graduate School, Sage Graduate Center, Cornell University. The completed applications are to be returned to the Graduate School. Two letters of recommendation from individuals in academic pursuits who know the applicant personally, and official transcripts of record from all the institutions of higher learning attended by the applicant are also required.

The applications from United States citizens and from foreign applicants who reside in the United States and Canada must be accompanied by a $15 nonrefundable application fee. Foreign applicants residing elsewhere who have been accepted for admission must pay this application fee before registration.

Foreign applicants whose native language is not English but who received their secondary school or their university education in the English language must submit a statement certifying to this, signed by a responsible officer of a United States Embassy or Consulate or by an appropriate official of the educational institution involved. All other foreign applicants must take the National Council Test of English as a Foreign Language by arrangement with Educational Testing Service, Princeton, New Jersey, U.S.A., or the Michigan English Language Test by arrangement with the English Language Institute, University of Michigan, Ann Arbor, Michigan, U.S.A. In either case, the test scores must be reported directly by the testing organization to the Graduate School as part of the essential application information, and no final action on applications will be taken until the scores have been received. Both testing programs are available throughout the world. Information on times and places for administration of the tests may be obtained directly from the addresses given above. Since these tests are diagnostic, admission to those applicants whose scores indicate unsatisfactory command of English may be denied or may be made contingent upon evidence of improved command of English.

All applicants for admission are urged to take the Graduate Record Examination (GRE) Aptitude (Verbal and Quantitative) Tests of the Educational Testing Service, and to have the scores sent to the Cornell Graduate School as part of their application materials. Information about the times and places of test administrations may be obtained directly from the Educational Testing Service, Princeton, New Jersey. The following Fields in the Graduate School require recent GRE Aptitude Test scores as a basis for action on applications: *Animal Physiology, Anthropology, Architecture, *Biology, Business and Public Administration, Child Development and Family Relationships, City and Regional Planning, Classics, *Conservation, *Economics, †Education, *English, Geology and Geography, *Government, History, †Household Economics and Management, Industrial and Labor Relations, Linguistics, Microbiology, Music, *Psychology, *Romance Studies, Rural Sociology, Sociol-

* These nine Fields require scores of both the Aptitude Test and the pertinent Advanced Test.

† Scores of the Miller Analogies Test, or the Graduate Record Examination Aptitude Tests, or both, are required from applicants whose native language is English.

ogy, Speech and Drama, Textiles and Clothing, and *Zoology. The Field of Veterinary Medicine requires Graduate Record Examination Aptitude Test Scores of all applicants from countries other than the United States and Canada. For applicants in other Fields, the Dean may require GRE Aptitude Test scores as additional information in connection with applications which involve marginal academic records or study at institutions that are not known to him. In addition, it is strongly recommended that applicants who are applying for a fellowship or scholarship from Cornell submit the Graduate Record Examination scores with their applications.

CATEGORIES OF ADMISSION

1. Candidacy for a Degree

It is expected that most applicants for admission will be candidates for an advanced degree. This may be the degree of Master of Arts or Master of Science, one of the professional Master's degrees listed on pages 145 to 149; or it may be the degree of Doctor of Philosophy, or one of the professional doctoral degrees listed on pages 147 to 149. Except under unusual circumstances, those who already hold an advanced degree are not admitted to candidacy for the same degree. The several Fields of the Graduate School vary as to whether students who do not hold Master's degrees are required to initiate graduate studies at that level; the faculties in some Fields wish their students to do this. Since Cornell has a strong commitment to doctoral work, however, many students are encouraged to undertake Ph.D. study directly after completion of the baccalaureate.

2. Provisional Candidacy

Under circumstances in which it is difficult to evaluate the academic background of qualified applicants, they may be admitted to *provisional* candidacy. Such status is often appropriate to the foreign student. Ordinarily only one semester of study in provisional candidacy is permitted, and the student who fails to qualify for candidacy at the end of that time may be requested to withdraw from the University. In any event, no more than two semesters of study in provisional candidacy are permitted, and of these no more than one may be considered as applicable to the residence requirement for a degree.

3. Non-Candidacy

When staff and facilities are available, the Graduate School will admit some applicants who do not intend to work toward an advanced degree at Cornell but who have special objectives for formal study or scholarly work at the graduate level. In order to be admitted for study in non-

candidacy, the applicant must satisfy all the entrance requirements expected of degree candidates. Registration in non-candidacy is restricted to two semesters.

4. Postdoctoral Study and the Visiting Fellow

To the extent possible, Cornell welcomes mature scholars who wish to work with members of the faculty for the advancement of knowledge, making use of the libraries and laboratories of the University. Increasingly, younger scientists who have recently completed their doctoral work at other institutions come to Cornell for one to three years as postdoctoral fellows or research associates, taking part in the ongoing research work of the faculty members. Established scientists and scholars who wish to work on the campus may, upon recommendation of the appropriate department head and endorsement of the college dean, be given the title of Visiting Fellow by the President. Visiting Fellows may perform no formal duties and may receive no salary from the University. They are requested to inform the Office of the Vice President for Research and Advanced Study, 303 Day Hall, of their presence on campus. Agencies and foundations sponsoring Visiting Fellows are expected to provide for the direct and indirect costs to the University which result from the studies carried on at Cornell. Research performed or courses attended as a Visiting Fellow are not credited toward advanced degrees, nor is any record kept of such work.

CHANGE OF STATUS

A student who wishes to change his status from non-degree candidacy to regular candidacy or from one degree or field to another, or who, after receiving the Master's degree, wishes to undertake candidacy for the doctorate, must submit a request in writing to the Dean of the Graduate School asking for transfer to the new status. Reasons for the change in status should be given. Provisional candidacy is automatically reviewed at the end of each semester, and no letter is necessary in this instance.

REGISTRATION

The time of registration for the fall and spring semester, Summer Research, and Summer Session are given in the Graduate School Calendar.

All graduate students in residence and using facilities of the University, whether or not they are taking courses, must register with the Graduate School and with the Registrar at the specified times unless granted a leave of absence by the Dean of the Graduate School. Before the fall term, the Registrar notifies each student of an hour at which he is to report, and anyone who does not have notification at least a week before registration day should communicate with the Graduate School. For the spring term, the Registrar notifies only *readmitted* students who have not been registered during the fall term, and *new* students. All

others should claim registration permit cards at Barton Hall at a time announced in the college offices, the *Cornell Daily Sun,* and the fall term final examination schedule.

When registering, the student should report to the table of the Graduate School, not to that of a college. He must register in person, not by proxy. If he cannot appear on the appointed day, he must report to the Graduate School Office as soon as possible, bringing a written explanation endorsed by his adviser or chairman. The Registrar requires a fee of $10 of any student for late registration, not as a fine but as a payment of additional cost to the University for registering a student out of phase.

FULFILLMENT OF DEGREE REQUIREMENTS

THE SPECIAL COMMITTEE

The Special Committee under which a Master of Arts or Master of Science candidate carries on his work is composed of a chairman, who represents the major subject, and one representative of an appropriate minor subject. The Special Committee of a doctoral candidate is composed of a chairman, representing the major subject, and representatives of two minor subjects. Occasionally there may be more than one representative of a subject or more than the minimum number of minor subjects.

Each Special Committee has responsibility for the development of a program of studies which best fits the needs of the candidate within the framework of the general requirements of the Graduate School and the more specific standards and requirements agreed upon by the members of the Fields concerned.

MAJOR AND MINOR SUBJECTS

The selection of the major subject and the chairman of the Special Committee necessarily comes first. It is the privilege of the graduate student to ask a member of the Graduate Faculty who is in the Field of the major subject to serve as his chairman. The chairman, in turn, advises the candidate about minor subjects and faculty members who may be willing to represent them on his Special Committee. The choice of major and minor subjects and the formation of the Special Committee must be recorded in the Graduate School Office on the proper forms within two weeks of the beginning of the first semester in candidacy.

In the larger Fields of the Graduate School the difficulties of wise selection are so great that the Field Representative or other faculty members may serve temporarily as the chairmen of the Special Committees of students who will subsequently find other chairmen to supervise their programs of study. Such temporary chairmen must be replaced

by permanent ones no later than the beginning of the second semester of candidacy.

When there is to be a change of chairman or minor representatives or a change of major or minor subject within the same Field, special Change of Committee forms must be properly filled out and approved by the newly constituted Special Committee, by retiring members, and by the Graduate School before the change takes effect.

The members of the Special Committee decide upon the candidate's program of study and research and whether he is making satisfactory progress, and they recommend the award of the degree. They conduct and report on all examinations required for the degree and approve and accept the thesis. The Committee and the candidate constitute an independent working unit. All members of the Graduate Faculty, however, are free to participate in the scheduled examinations and to review the theses of candidates for degrees.

RESIDENCE

The Graduate Faculty regards study in residence as essential. Although a person working off-campus may attain proficiency in a technique or even in a field of knowledge, he may fail in other ways to become such a representative as the School hopes to produce. In addition to contact with the libraries and physical facilities of the University, he needs the acquaintance, company, aid, and stimulus of others engaged in work like his own; he should form the habit of attending lectures and recitals and the meetings of groups in whose activities he takes interest.

Residence Eligibility

Full-time study for one semester with satisfactory accomplishment constitutes one residence unit. The Graduate Faculty requires that each candidate for a Master's degree earn two units of residence; that each candidate for the Ph.D. earn six units. In general, the time required for completion of work in candidacy for a degree exceeds these minimum requirements. Residence credit is recommended by the candidate's Special Committee in accordance with the formula for residence credit eligibility stated below when in the Committee's opinion the student has satisfactorily completed a term's work. As a general rule, the Graduate School will not permit anyone to receive credit for more than two residence units in the period of twelve consecutive months subsequent to the beginning of the academic year.

A candidate for the doctorate may earn no more than two units for work done in Summer Research, Summer School, and the Division of Extramural Courses. At least four of the six units must be earned as a full-time student, earning three-quarters of a residence unit or more each term. Two of the last four units must be earned in successive terms of full-time study on the Cornell campus.

The legislation with respect to eligibility of part-time employees for residence units is as follows:

EMPLOYMENT	RESIDENCE UNITS ALLOWABLE PER SEMESTER		
Total clock hrs. per week	*Contributory in the major field of study and on campus*	*Non-contributory but on campus*	*Off campus*
0–10 hours	1 unit	1 unit	1 unit
11–20 hours	1 unit	¾ unit	¾ unit
21–30 hours	¾ unit	½ unit	*(See paragraph below)*

If the employment is more than 20 clock-hours per week and is off campus, or if it is more than 30 clock-hours per week under any circumstances, a maximum of two-fifths of a residence unit per semester may be earned through registration in the Division of Extramural Courses, *but this will be permitted only on the basis of petition approved prior to the time that the work is undertaken.* For the degree of Master of Arts or Master of Science a maximum of one unit, and for the degree of Ph.D. a maximum of two units of residence may be earned in this way.

DIVISION OF EXTRAMURAL COURSES

Master's degree candidates whose employment within or outside the University restricts them to *less* than one-half of a residence unit during a term may accumulate a maximum of one residence unit for work in the Division of Extramural Courses. Instruction is offered in certain fields of study both on and off the campus. Fifteen credit hours are the equivalent of one residence unit, and six credit hours the equivalent of two-fifths of a residence unit – the smallest fraction that will be recorded by the Graduate School toward fulfillment of residence requirements. Detailed information concerning extramural courses and registration procedures may be obtained from the Division of Extramural Courses.

SUMMER SCHOOL

To receive two-fifths of a unit for work in the Summer School, the candidate must register in both the Summer School and the Graduate School and must file a statement of courses satisfactory to his Special Committee. Residence credit is not allowed for less than six credit hours or for unit courses, except when two three-week unit courses are taken successively the same summer and, thereby, considered the equivalent of the six-week Summer School. By arrangement with his Committee, a candidate may secure all of his residence for the Master's degree by attending Summer School.

SUMMER RESEARCH

Although a maximum of two residence units may be earned in a period of twelve consecutive months beginning with the first semester of the academic year, it is expected that most graduate students will continue their studies during the summer period. Provision is made for those who have earned one or two units of residence in the previous academic year to make use of the facilities of the University during the subsequent summer. Such students also have access to the regular services of the University Clinic and Hospital without additional charge. For details see page 151 under General Fee.

A candidate who has been in residence at Cornell during two regular semesters and who is eligible for summer residence units may, on recommendation of his Special Committee and with the approval of the Dean at least one week in advance, be permitted to register for an eight-week period of Summer Research under the personal direction of a member of the Graduate faculty.

One-half residence unit may be granted upon certification of satisfactory completion of full-time study during the eight weeks for which the candidate has registered. Assistants under contract during the summer or during the Summer School may be permitted to study for twelve weeks for one-half of a residence unit. Those employed part-time in the summer, other than on twenty-hour assistantships, should inquire at the Graduate School Office as to their residence eligibility during the summer. A maximum of two units may be earned in Summer Research.

In addition, students who hold a fellowship or scholarship for the summer months, or who will be applying for a loan in the summer, will need to register in order to collect their checks. For these purposes a non-credit registration is available.

Applications for both credit and non-credit registration are obtainable at the Graduate School Office. The Summer Research period extends from the end of the spring term to the beginning of the fall term — normally fourteen weeks in length.

Transfer of Residence

Candidates for the Master's degree may not count study in other graduate schools as part of their residence. Candidates for the doctorate may be permitted to count study for the Master's degree as equivalent to two residence units; those who have received training of an exceptional quality and amount may petition for more. No commitment regarding this may be made until after the student has entered into residence, and his Special Committee has had further opportunity to judge his accomplishments. The residence transferred cannot exceed that which would have been earned under similar circumstances at Cornell. Credits secured during study as an undergraduate or as a Special Student, even for work in courses designed primarily or wholly for graduate students, will not be allowed.

Continuity of Residence

A candidate is expected to register each fall and spring term until he completes all requirements for the degree. If he finds this impossible, he must apply for a leave of absence or withdraw from the Graduate School. A candidate must complete all requirements for a Master's degree within seven years, and for a doctoral degree within ten years of the time of first registration in the Graduate School.*

A candidate who wishes readmission following a leave of absence should submit a written request to the Graduate School. If he has not registered during the preceding four years, he will be permitted to re-enroll only after the General Committee has stipulated what previous residence units he may retain.

FOREIGN LANGUAGE READING PROFICIENCY REQUIREMENTS

For the Doctorate

A candidate for the degree of Ph.D. must demonstrate reading ability in two languages besides English, which have been approved as important languages of scholarship in the Field of his major subject. Languages fulfilling the requirement include French, German, Russian, and such other languages as have been approved for a Field by the General Committee of the Graduate School. Any Special Committee may, at its discretion, require knowledge of foreign language beyond or more specific than the requirements stated above.

Petitions for a language substitution may be submitted by an individual candidate with the approval of the Special Committee concerned and will be considered on the merit of the claim that the substituted language is also an important language of scholarship in the broad area of the candidate's Field. For foreign students, the native language will be open to consideration on the same basis.

Any student who does not fulfill all the language requirements upon admission to Ph.D. candidacy is required to give satisfactory evidence to his Special Committee that he is undertaking, without delay, serious study aimed at removing the language deficiency. After two semesters in residence have elapsed, the candidate must register in courses of instruction in any languages in which he is still deficient until the requirements are satisfied. Final Examination B may not be scheduled, nor approval granted for Final Examination C, unless the requirements in language have been satisfied.

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* Exceptions to the 10-year limit as stated above may be permitted under some circumstances.

For the Masters' Degrees

Each Field of instruction states its language requirements in its own section of this Announcement. If *college entrance language* is specified, the candidate's transcript of record must indicate that he has earned three college entrance units in one language, or two units in each of two languages, or the equivalent in college study. If *proficiency* is specified, the candidate must take and pass the examination described below. Any exception to the requirement must be approved by the specific Field.

Any Special Committee may, at its discretion, require knowledge of foreign language beyond the announced requirements.

Upon change of status from Master's to Doctor's candidacy, only the languages designated as meeting the requirements for the Ph.D. degree will be accepted.

Foreign Language Reading Examinations

Candidates required by Fields or by the Graduate School to demonstrate ability in reading French, German, or Russian must pass the Graduate School Foreign Language Test given by the Educational Testing Service, Princeton, New Jersey, and administered by the Graduate School. A charge is made to cover the cost of administering each test. As an alternative, candidates may pass, with a score satisfactory to the Division of Modern Languages, the reading part of the appropriate CEEB college language test.

A candidate who fails a language examination will not be given permission to take another examination in that language until he presents evidence of substantial further preparation in the form of course work or tutoring.

Candidates who take examinations in languages other than French, German, or Russian should arrange with the Graduate School Office for assignment to a suitable examiner.

A student may petition the Dean to transfer a language examination taken elsewhere to his record at Cornell.

INSTRUCTION IN FRENCH, GERMAN, AND RUSSIAN

Courses designed to aid graduate students in learning how to read French, German, and Russian are given by the Division of Modern Languages in cooperation with the Graduate Faculty. There are two courses offered each term — one at the elementary and one at the intermediate level — in each of the languages. Anyone registering for them is expected to attend regularly throughout the term, take all examinations, and complete assigned work.

ELEMENTARY FRENCH, GERMAN, or RUSSIAN 151. Three hours. MWF (time to be announced).

INTERMEDIATE FRENCH, GERMAN, or RUSSIAN 152. Three hours. MWF (time to be announced).

COURSES AND REGISTRATION IN COURSES

Graduate students have the privilege of registering in any University course which can accommodate them no matter whether it is announced as primarily for graduates or undergraduates. Details regarding all offerings will be found in the Announcements of the various colleges; the name of the college that lists the material has been placed after the name of the field of instruction (see pages 53–144).

Although most graduate students undertake a considerable amount of course work and are expected by their Special Committees to give evidence of satisfactory progress in those courses, the accumulation of credit hours is not regarded as an index of a student's progress or as a guarantee that he will receive the degree. All decisions as to courses of study are delegated to the Special Committee of the graduate student. For the convenience of all, however, the Graduate School does require that the instructor in each course submit a grade to be entered upon the student's record.

A student who wishes to change a course for which he originally registered may do so by filing a Change of Course Registration form in the Graduate School Office *up until the date specified.* (See the calendar in this Announcement.) Any changes after this date can be made only by a written request from the student to the Dean of the Graduate School giving reasons for the change. The letter must be signed by the course instructor and the student's special committee chairman and, if the change is approved in the Office of the Graduate School, a $10 late fee is usually required.

EXAMINATIONS

The Special Committee conducts all examinations required for the degree, but the candidate is responsible for seeing that the final examinations are scheduled with the Graduate School at least seven days in advance. Formal registration as a regular student or as a "Candidate for Degree Only" is required for all Final Examinations. Any member of the Graduate Faculty is privileged to take part in questioning the candidate. The Special Committee may also require other examinations than those listed below. Properly completed forms reporting the results of the examination should be filed in the Graduate School Office within 24 hours after the examination.

At the discretion of the Special Committee, Final Examinations may be entirely oral, or both oral and written. The following examinations are required by the Graduate School:

FOR THE MASTERS' DEGREES: a Final Examination, which under certain conditions may be combined with the Qualifying Examination for the doctorate. (See *Code of Legislation,* Paragraphs 96–97.)

FOR THE DOCTORAL DEGREES: (1) A Qualifying Examination to determine the applicant's fitness for undertaking advanced studies, and

to enable the Special Committee to plan a program which will make him familiar with the requisite knowledge and techniques. An early date for this examination is therefore considered essential, and the Graduate School requires that all candidates complete three units of residence after passing it. (2) A Final Examination. Except by prior arrangement with the Graduate School, this must be taken in two parts — Examination A, given not earlier than the last month of the fourth unit of residence and at least four months before the second part; and Examination B, on the thesis and related material. Final Examinations A, B, and C (A and B combined) are publicized so that any member of the Graduate Faculty who wishes may attend.

THESIS OR ESSAY

Every candidate for a degree must present two copies of his thesis or essay to the Graduate School and must complete other formalities incidental to making it available in the University Library. The thesis or essay must be written in English unless special permission has been obtained by petition from the General Committee of the Graduate School for the use of a substitute language. In form, it must be as described in other publications of the Graduate School, and it must satisfy the candidate's Special Committee in both scholarship and literary quality.

Since candidates for the Master's degree enter upon their work with various aims and considerable variety of preparation, their Special Committees will determine the importance of the thesis in rounding out each individual's program. Some students may use most of their time in attending courses in order to broaden their knowledge: for them the essay may be a secondary consideration. Others may concentrate upon pieces of research best handled in a thesis necessitating expenditure of much of their time and effort; the Special Committee will therefore strive to give such projects a prominent place in planning the candidate's work and in judging his success.

Doctoral theses should demonstrate that, in addition to becoming acquainted with materials and methods, the candidate possesses the ability and technique needed for carrying on original research. The faculty requires publication of these theses by abstract and microfilm.

FINANCIAL SUPPORT

ASSISTANTSHIPS

Throughout the University there are a great many opportunities for graduate students to supplement their income while at the same time gaining valuable experience. These consist of part-time appointments as assistants in teaching, research, or administration usually contracted for through the college, school, or department with which the student will be associated. Care is taken by the administrative officers

and the Graduate Faculty to ensure that the appointments and duties are as closely related to the students' graduate programs as possible. Usually the duties of the assistant are in the Field of his major interest and so contribute to his intellectual and technical proficiency in the Field. Normally assistantships require 10 to 20 clock-hours per week of the student's time, depending on the Field. An assistant whose duties in the Field of his major interest do not exceed 20 hours is eligible for a full residence unit each semester. The Graduate Faculty regulations concerning residence are spelled out on page 00. Assistantship remuneration varies widely but is usually from $1600 to $2600 per academic year, and it is supplemented by a scholarship which covers tuition and fees, or by a tuition waiver. Applications for such appointments should be addressed to the chairman of the department concerned.

RESIDENCE HALL ASSISTANTSHIPS

Assistantships in University residence halls are available for men and women graduate students in any academic field. They are most appropriate for graduate students who desire experience in working with undergraduate students and University staff while contributing financially to their own study.

In the women's area one-third of the fifteen assistantships available are reserved for graduate students in the field of Student Personnel Administration. Ten assistantships, offering living expenses and a yearly stipend, are available to graduate women in other disciplines. Particulars and application forms may be obtained by writing to the Office of the Dean of Students, 133 Day Hall.

In the men's housing area there are three types of positions, all requiring a personal interview. There are 45 counselor positions available to single undergraduate and graduate men. Each counselor is responsible for a floor containing 55 freshmen. Counselor positions carry free room for the first year and a $200 stipend in the second. There are also eight positions of associate head resident, which is the second administrative position in a dormitory of 250 men. Single graduate students are eligible for this position, which provides room plus a $500 stipend. The nine head resident positions are open to married graduate students without children. Each head resident is responsible for a dormitory of 250 men and five staff. The head resident lives in a two-room apartment and receives a $700 stipend.

Unmarried applicants are considered as a group in assignment to positions of either counselor or associate head resident. Applications should be addressed to the Office of the Dean of Students, 133 Day Hall. The deadline for application for positions in men's dormitories is February 1.

FELLOWSHIPS AND SCHOLARSHIPS

A *fellowship* ordinarily is awarded in open competition to a full-time student who is expected to be a candidate for a higher degree. The

award is made as a tax-exempt gift, and it covers not only tuition and fees but may also make a substantial contribution toward living expenses during tenure. A student who holds a fellowship is free to select his own research project, and his primary responsibility is to pursue his studies for his degree. The award of the fellowship does not obligate the holder to render services to the University, nor does it commit him in respect to future employment. The holder of a fellowship may accept no other appointment or employment without permission of the Fellowship Board; however, teaching or research responsibilities will usually be approved as a routine matter if they contribute to the student's graduate program and do not exceed ten clock-hours of work per week.

A *scholarship* is likewise a gift and is free from income tax, but the amount of the award usually is less than that of a fellowship. It generally covers expenses such as tuition and fees (or similar cash grant) without a material contribution to living expenses. The holder of a scholarship may, on approval of the Fellowship Board, accept limited employment.

Both fellowships and scholarships are awarded primarily on the basis of scholastic ability and promise of achievement as a graduate student. Financial need will also be considered in the award of scholarships but not of fellowships.

Application for a fellowship or scholarship is made to the Graduate School, Sage Graduate Center, Cornell University, on the application form obtained from that office. The applicant either must be a matriculated student in the Graduate School or must simultaneously file an application for admission with necessary credentials.

Under the rules of the Council of Graduate Schools in the United States, the regular time for notification of award of fellowships and scholarships for an academic year is April 1. *All fellowship and scholarship applications received by the deadline date (see Calendar) will be considered for April 1 awards, and on that day each applicant will be notified as to whether he has or has not been awarded a fellowship, or scholarship, or named as an alternate.* It is hoped that the awardees will notify the Graduate School no later than April 15 of their acceptance or rejection of the award. Failure to do this by April 22 will be considered a declination. Applications received after February 8 may be considered at a later date if vacancies occur because of withdrawal of principals and alternates or for other reasons. Fellowships and scholarships are usually granted for an academic year, but under some conditions they may be awarded for a single semester. Scholarships are also available for the Summer Research period, primarily to Ph.D. candidates in the terminal year.

The locally administered fellowships and scholarships available for 1966–67 are listed below; however, the listing is subject to change, as are also the amounts quoted as stipends. Unless otherwise specified, all awards are for the academic year and cover tuition and the General Fee. Information about tuition and fees for the 1966–67 academic year can be found on pages 150–152.

The Graduate School Office also maintains various files on fellowships and scholarships administered by foundations and national agencies

such as the Atomic Energy Commission, National Aeronautical and Space Administration, National Science Foundation, National Institutes of Health, National Defense Education Act Titles IV and VI, etc. Application for NSF and NASA Traineeships and NDEA Title IV Fellowships are made as for Cornell awards. See also the listings on these below. For information on Woodrow Wilson Foundation National Fellowships inquire at 114 Sage Graduate Center. Each year several hundred Cornell graduate students receive support from these outside sources. Of particular interest to residents of New York State are scholarships and fellowships awarded by the New York State Education Department, including Scholar Incentive payments, Herbert H. Lehman Fellowships, Regents Scholarships for Graduate Study in Medicine and Dentistry, Fellowships for doctoral study in arts, science, or engineering, and Regents College Teaching Fellowships. For further information on state aid inquire at the Office of Financial Aids, Edmund Ezra Day Hall, in person; or write to Regents Examination and Scholarship Center, New York State Education Department, Albany, New York 12224.

Open to Applicants in All Fields

ANDREW DICKSON WHITE FELLOWSHIPS, $3000 plus tuition and General Fee. To be awarded to first-year students of truly exceptional promise, with provision for renewal for two additional years on recommendation of the major field.

ANDREW DICKSON WHITE FELLOWSHIPS, $2500 plus tuition and General Fee. To be awarded to first-year students of truly exceptional promise.

CORNELL SENIOR GRADUATE FELLOWSHIPS, $2500 plus tuition and General Fee. To be awarded to doctoral candidates in the final year of graduate study.

CORNELL GRADUATE FELLOWSHIPS, $2000 plus tuition and General Fee. Intended for outstanding first-year or continuing students.

CORNELL GRADUATE TEACHING FELLOWSHIPS. Four years of continuous support are provided to outstanding graduate students who show a definite interest in teaching. Two years of fellowship support, usually the first and fourth, will provide stipends of $2000 and $2500 respectively plus tuition and General Fee. Two years of teaching assistantship will normally come between the fellowship years, and will be in the department of the student's major, supported by that department. Other sequences of fellowship and assistantship years may be arranged.

ALLEN SEYMOUR OLMSTED FELLOWSHIPS, $1500 plus tuition and General Fee. Two to be awarded. Preference will be given to students beyond the first year of graduate study.

THE ALPHA OMICRON PI FELLOWSHIP provides $1800 and is available to women graduate students, with preference (other qualifications being equal) to members of Alpha Omicron Pi.

CORNELL-GLASGOW EXCHANGE FELLOWSHIP. One to be awarded for study at the University of Glasgow. Includes tuition, board and room,

plus £120, and an allowance of $400 for travel. Limited to graduate students at Cornell. Preference given to doctoral candidates. One to be awarded for study at Cornell University to a matriculated student at Glasgow University. Includes a stipend of $2000 plus tuition and General Fee, the registration deposit, and a Fulbright travel grant from Scotland to the United States and return.

GERMAN FELLOWSHIPS. Cornell graduate students needing to do research or study in German universities may apply to the German Scholarship Committee, Professor Herbert L. Kufner, Chairman, for information on the availability of German Fellowships which provide tuition, fees, and maintenance. Several are available, of which one is at the University of Heidelberg and two at the University of Göttingen.

TRAVEL GRANTS ranging up to $500. To be awarded for use in thesis research.

TUITION AND GENERAL FEE SCHOLARSHIPS. To assist well-qualified students whose financial resources would not be adequate to maintain them during their period of study. A statement of financial need is required.

SUMMER RESEARCH SCHOLARSHIPS ranging up to $750. Primary consideration will be given to doctoral candidates in their terminal year of study. All applicants must have maintained superior scholastic standing and show evidence of financial need. *Applications for these scholarships are to be filed between April 1 and May 1.*

Open to More than One Area

ACADEMIC YEAR INSTITUTE FOR SECONDARY SCHOOL AND COLLEGE TEACHERS OF BIOLOGY, CHEMISTRY, EARTH SCIENCE, MATHEMATICS, AND PHYSICS. If continued in 1966–67, the Cornell AYI will provide stipends for 35 secondary school and 10 junior college participants from funds provided by the National Science Foundation. Inquiries should be directed to the Graduate School, prior to December 1, 1965.

CHINA PROGRAM FELLOWSHIPS (China, Japan, Taiwan) ranging up to $2500 plus tuition and General Fee. Open to candidates in the China Program. Apply to the Director of the China Program, Franklin Hall.

SOUTH ASIA PROGRAM FELLOWSHIPS (Bhutan, Ceylon, India, Nepal, Pakistan, Sikkim) ranging up to $2500 plus tuition and General Fee. Open to candidates in the South Asia Program. Apply to the Director of the South Asia Program, 400C White Hall.

SOUTHEAST ASIA PROGRAM FELLOWSHIPS (Burma, Cambodia, Indonesia, Laos, Malaysia, Philippines, Thailand, Vietnam) ranging up to $2500 plus tuition and General Fee. Open to candidates in the Southeast Asia Program. Apply to the Director of the Southeast Asia Program, Franklin Hall.

CORNELL SIGMA XI FELLOWSHIP, $2500 plus tuition and General Fee. Open to terminal candidates in the Field of Anthropology and the Areas of the Biological and Physical Sciences.

HENRY STRONG DENISON FELLOWSHIPS IN AGRICULTURE, $1000 plus tuition and General Fee. Two available to candidates in the plant sciences, animal sciences, agricultural engineering, agricultural economics, rural education, and rural sociology. Preference will be given to those applicants who expect to complete the requirements for the doctorate and who appear most promising from the standpoint of ability to conduct research. In certain instances these fellowships may be combined with part-time employment.

I.B.M. FELLOWSHIP, $1800 plus tuition and General Fee, with provision for $700 more if the candidate is married and has at least one child. Open to candidates in the humanistic fields who will use computers and computer methods in their graduate program.

INTERNATIONAL STUDIES FELLOWSHIPS, $3000 plus tuition and General Fee. Open to Ph.D. candidates who have passed Examination A and whose research will make a significant contribution to international studies.

CLINTON DeWITT SMITH FELLOWSHIP IN AGRICULTURE, $1200 plus tuition and General Fee. Open to students who come from farm homes and who have had farm training.

GENERAL FOODS FELLOWSHIPS IN HOME ECONOMICS, $2225 plus tuition and General Fee for a Ph.D. candidate; $1225 plus tuition and General Fee for a Master's candidate.

KATHARINE WYCKOFF HARRIS FELLOWSHIP IN HOME ECONOMICS, $1450 plus tuition and General Fee. Open to candidates whose Special Committee chairman or minor representative is a member of the faculty of the College of Home Economics. Preference will be given to candidates in the Field of Institution Management.

ANNA CORA SMITH SCHOLARSHIP IN HOME ECONOMICS, up to $125 plus tuition and General Fee.

FLORA ROSE FELLOWSHIP IN HOME ECONOMICS, $675 plus tuition and General Fee.

HERBERT AND LILLIAN M. POWELL FELLOWSHIP, $1450 plus tuition and General Fee for "a Protestant woman in the Field of Home Economics." Preference will be given to a candidate in the Field of Textiles and Clothing or the Field of Household Management.

McVOY FELLOWSHIPS AND SCHOLARSHIPS IN ECONOMICS, ENGLISH, HISTORY, PHILOSOPHY, SPEECH AND DRAMA, BUSINESS AND PUBLIC ADMINISTRATION, AND INDUSTRIAL AND LABOR RELATIONS. Awards will consist of amounts up to tuition and General Fee with, in special cases, some stipend added. Preference will be given by the Fellowship Board to members of the Alpha Delta Phi Fraternity at Cornell who are as well qualified as other applicants.

N.D.E.A. TITLE IV THREE-YEAR FELLOWSHIPS will be offered in certain fields. No special application form is required. In applying for admission, mention may be made of preference for this form of support on the application form. When available in the applicant's field, these fellowships provide stipends of $2000, $2200, and $2400 plus tuition and General Fee in the first, intermediate, and terminal academic years. An allowance of

$500 is available for each dependent. Grants of $400 for each summer following a year of fellowship, together with dependency allowances of $100 for each dependent, may be applied for. Candidates must be United States citizens planning to enter an academic career.

N.D.E.A. TITLE VI (MODERN FOREIGN LANGUAGE) FELLOWSHIPS are available to full-time graduate students preparing to teach at the college level a foreign language or a subject for which the foreign language training is essential. Study of the area related to the language is an important part of the fellowship program. Applicants must be citizens of the United States. Application may be made to the Graduate School on forms available from the Graduate School office. The fellowships provide $2250 plus tuition and General Fee and an allowance of $600 per dependent for an academic year. $450 plus $120 per dependent may be requested for summer study. Some travel expense is reimbursable. These fellowships may be renewed beyond the first year.

Humanities

OPEN TO MORE THAN ONE FIELD

GEORGE LINCOLN BURR FELLOWSHIP, $1900 plus tuition and General Fee. Open to Ph.D. candidates concentrating in medieval and Renaissance study. For specific information write to the Chairman, Interdepartmental Committee on Medieval and Renaissance Studies, Goldwin Smith Hall. (See page 39.)

LANE COOPER FELLOWSHIP, $2000 plus tuition and General Fee. This fellowship is open to students who aspire to become teachers in institutions of higher learning and whose fields of specialization are in the Humanities, including classics, English language and literature, history, Old and Middle English, and philosophy.

FLORENCE MAY SMITH FELLOWSHIPS, up to $2000 plus tuition and General Fee. Two available to students in the classics, Romance literature, or German literature. Preference will be given to students of the classics.

ARCHITECTURE

UNIVERSITY SCHOLARSHIP, $70 plus tuition and General Fee.

CLASSICS

UNIVERSITY SCHOLARSHIPS IN GREEK AND LATIN, $70 plus tuition and General Fee.

UNIVERSITY FELLOWSHIPS IN GREEK AND LATIN, $800 plus tuition and General Fee.

ENGLISH LANGUAGE AND LITERATURE

CLASS OF 1916 GRADUATE FELLOWSHIP, $1800–$2000 plus tuition and General Fee. May be available for 1966–67.

MARTIN SAMPSON TEACHING FELLOWSHIP, $1500 plus tuition and General Fee and a combination of $500 scholarship and $1000 assistantship

for services as a teaching assistant not to exceed ten clock-hours per week during the academic year.

HISTORY

GEORGE C. BOLDT FELLOWSHIP, $1100 plus tuition and General Fee.

GERTRUDE A. GILLMORE RESEARCH FELLOWSHIP, $1500 plus tuition and General Fee. Open to women students ordinarily in the last year of work for the doctorate.

PRESIDENT WHITE FELLOWSHIP, $1100 plus tuition and General Fee.

MOMMSEN TRAVELING FELLOWSHIP, $2000. Open to students majoring in medieval and Renaissance studies to finance travel to Europe for the purpose of study and research on a doctoral dissertation approval by the Field of History.

PHILOSOPHY

SUSAN LINN SAGE FELLOWSHIP, $1800 plus tuition and General Fee.

ROMANCE STUDIES

UNIVERSITY FELLOWSHIP, $800 plus tuition and General Fee. Not available in 1966–67.

H. C. BERKOWITZ FELLOWSHIPS, $2000 plus tuition and General Fee. Available to Ph.D. candidates with concentration in Romance literature and linguistics.

Social Sciences

OPEN TO MORE THAN ONE FIELD

LONDON-CORNELL STUDENTSHIPS ranging up to $3000 plus air fares and tuition and fees. Tenable for study during an academic year at the London School of Economics and Political Science and/or the School of Oriental and African Studies of the University of London. Open to advanced Ph.D. candidates in the social sciences (including modern institutional history) who are members of the China Program or of the Southeast Asia Program. Apply to the Cornell Director for the London-Cornell Project, 213 Rand Hall.

LONDON-CORNELL FIELD RESEARCH GRANTS ranging up to $12,000 inclusive of travel and research expenses. Tenable for up to 22 months for the purpose of dissertation field research in the area of China and/or Southeast Asia. Open to advanced Ph.D. candidates in the Social Sciences (including modern institutional history) who are members of the China Program or of the Southeast Asia Program. Apply to the Cornell Director of the London-Cornell Project, 213 Rand Hall.

BUSINESS AND PUBLIC ADMINISTRATION

THEODORE P. WRIGHT FELLOWSHIP OF CORNELL AERONAUTICAL LABORATORY, ranging from $2000 up plus tuition and General

Fee. Open to either Master's or Ph.D. candidates who are outstanding engineering or scientific graduates of any college or university. An additional $600 is available for married candidates.

CHILD DEVELOPMENT AND FAMILY RELATIONSHIPS

NATIONAL INSTITUTES OF MENTAL HEALTH TRAINEESHIPS, $1800 to $3000 plus tuition and General Fee. Nine available.

ECONOMICS

PRESIDENT WHITE FELLOWSHIP, $1000 plus tuition and General Fee.

ROBERT IRVING WARSHOW FELLOWSHIP, $2000 plus tuition and General Fee.

EDUCATION

COMSTOCK SCHOLARSHIP IN NATURE STUDY. Not available in 1966–67.

GOVERNMENT

NEWTON C. FARR FELLOWSHIP, a stipend plus tuition and General Fee will be awarded to a graduate student majoring in American institutions and history under the direction of the John L. Senior Professor.

HOUSEHOLD ECONOMICS AND MANAGEMENT

HELEN CANON SCHOLARSHIP IN HOME ECONOMICS, $400.

RUTH ADA BIRK EASTWOOD SCHOLARSHIP IN HOME ECONOMICS, $500.

HOUSING AND DESIGN

ED GAVIN MEMORIAL HOUSING SCHOLARSHIP, $225 plus tuition and General Fee. May be available in 1966–67.

INDUSTRIAL AND LABOR RELATIONS

INDUSTRIAL AND LABOR RELATIONS GRADUATE FELLOWSHIP, up to $2225 plus tuition and General Fee. Preference given to doctoral candidates.

KENNECOTT COPPER CORPORATION FELLOWSHIP IN INDUSTRIAL RELATIONS, $2500 plus tuition and General Fee.

TUITION SCHOLARSHIPS. Four available. General Fees not included. Primarily for foreign students.

Biological Sciences

OPEN TO MORE THAN ONE FIELD

ALLIED CHEMICAL CORPORATION FELLOWSHIP, $2000 plus tuition and General Fee. Available to candidates in the Field of Entomology in

1966–67 and those in the Field of Plant Pathology in 1967–68. Candidates must be U.S. citizens, preferably in final year of the doctorate.

SHELL FELLOWSHIP IN PLANT SCIENCE, $1800 or $2100 plus tuition and General Fee. Higher stipends are available to married candidates with children. Open to candidates in the Fields of Agronomy, Botany, Floriculture, Plant Breeding, Plant Pathology, Pomology, and Vegetable Crops. Preference will be given to applicants in the second or third year of graduate study. Applicant must be United States or Canadian citizen.

SCHUYLER-GAGE FELLOWSHIP IN ANIMAL SCIENCES, $1400 plus tuition and General Fee. Open to candidates in the Fields of Biochemistry, Conservation, Entomology, and Zoology.

WOODS HOLE SUMMER SCHOLARSHIPS, $150 to cover tuition for a six-week summer session at the Marine Biological Laboratory, Woods Hole, Massachusetts.

ANIMAL HUSBANDRY

MORRISON FELLOWSHIP IN LIVESTOCK FEEDING, $2000 plus tuition and General Fee.

BIOCHEMISTRY

NATIONAL INSTITUTES OF HEALTH TRAINEESHIPS. $2225 plus tuition and General Fee (12-month tenure).

NATIONAL SCIENCE FOUNDATION TRAINEESHIPS: See listing under Physical Sciences.

ENTOMOLOGY

COMSTOCK SCHOLARSHIP. $100 plus tuition and General Fee.

FLORICULTURE AND ORNAMENTAL HORTICULTURE

ALFRED HOTTES AMATEUR GARDENING FELLOWSHIP, $1800 plus tuition and General Fee.

FOOD SCIENCE AND TECHNOLOGY

NATIONAL INSTITUTES OF HEALTH TRAINEESHIPS ranging from $2625 up, plus tuition and General Fee on a twelve-month basis. Available to predoctoral and postdoctoral candidates.

POMOLOGY

AUCHTER FELLOWSHIP, ranging from $2000 to $2200 plus tuition and General Fee.

PSYCHOLOGY

SUSAN LINN SAGE FELLOWSHIP, $1200 plus tuition and General Fee.

DALLENBACH FELLOWSHIP, $1800 plus tuition and General Fee.

NATIONAL INSTITUTES OF MENTAL HEALTH TRAINEESHIPS, $1800 plus tuition and General Fee.

Physical Sciences

OPEN TO MORE THAN ONE FIELD

SPECIAL GRADUATE FELLOWSHIPS IN ENGINEERING. New and continuing graduate students studying toward the degree of Ph.D. in any of the Fields of Engineering and who plan to enter the academic profession are eligible for special fellowships provided by a grant to the College of Engineering by the Ford Foundation. These fellowships are for study during a twelve-month period and may be combined with teaching or research assistantships to provide a maximum annual total of $3400 for the first, $3600 for the intermediate, and $3800 for the terminal year, of which not more than $2400 may be provided from the special fellowship. Tuition and General Fee will also be provided. Opportunity is also provided for loans to graduate students which are forgivable to those who undertake college teaching after completing their doctoral studies. Inquiries concerning loans may be directed to the Office of Scholarships and Financial Aid, Day Hall.

JOHN McMULLEN GRADUATE FELLOWSHIPS, $2000 plus tuition and General Fee. One available in each Field of Engineering. Applicants should apply directly to the Field Representative.

NASA TRAINEESHIPS available on a 12-month basis. $2400–$2800 plus tuition and General Fee. A $600 allowance is available if recipient is married and has one or more children. Open to United States citizens, preferably in the first year of graduate study leading to a doctorate. Renewal for a second and third year is available.

NATIONAL SCIENCE FOUNDATION TRAINEESHIPS available on a 9-month or 12-month basis to graduate students in mathematics, biochemistry, physical sciences, and engineering. Stipends are $2400, $2600, and $2800 on the 12-month basis for first, second, and third years. Tuition and General Fee will be paid, and $500 per dependent is allowed on the 12-month basis. Candidates must be United States citizens and the majority of the awards will be given to those entering their first year of graduate study.

SUN OIL FELLOWSHIP IN ENGINEERING PHYSICS AND MATERIALS SCIENCE, $2250 plus tuition and General Fee. A $500 allowance is available if the recipient is married and has one or more children.

XEROX FELLOWSHIP, $2500 plus tuition and General Fee. Open to students in the first year of graduate study majoring in any of the Fields encompassed by the Materials Science Center, such as Chemistry, Electrical Engineering, Applied Physics, Materials Science and Engineering, and Physics.

AEROSPACE ENGINEERING

The THEODORE VON KARMAN FELLOWSHIP, the HERMANN GLAUERT FELLOWSHIP, the ERNST MACH FELLOWSHIP, and the LUDWIG PRANDTL FELLOWSHIP, (all of Cornell Aeronautical Laboratory) all provide $2000 or more plus tuition and General Fee and a dependency allowance of $600 for married fellows.

APPLIED PHYSICS

RADIO CORPORATION OF AMERICA FELLOWSHIP, $2100 plus tuition and General Fee. A $900 allowance is available if recipient is married and has one or more children. The sum of $500 may be added to the stipend for 12-month tenure. Recipient must be a United States citizen or declare intention to remain in the United States as a resident.

AVCO GRADUATE FELLOWSHIP, $1800 plus tuition and General Fee.

CHEMICAL ENGINEERING

DIAMOND ALKALI GRADUATE FELLOWSHIP, $2400 plus tuition and General Fee on a 12-month basis.

LUBRIZOL FELLOWSHIP, $2500. Open to Ph.D. candidates in the third or fourth year of graduate study.

PROCTER AND GAMBLE FELLOWSHIP, $2000 plus tuition and General Fee.

STANDARD OIL COMPANY OF CALIFORNIA FELLOWSHIP, $1800 plus tuition and General Fee. Provision for additional $600 if recipient is married and has at least one child.

CHEMISTRY

DOW CHEMICAL COMPANY SUMMER RESEARCH SCHOLARSHIPS, $560.

MOBIL CHEMICAL COMPANY SUMMER RESEARCH SCHOLARSHIPS, $560.

MONSANTO COMPANY SUMMER RESEARCH SCHOLARSHIPS, $560.

PROCTER AND GAMBLE COMPANY SUMMER RESEARCH SCHOLARSHIPS, $560.

GULF RESEARCH AND DEVELOPMENT COMPANY FELLOWSHIP IN PHYSICAL CHEMISTRY, $2700 plus tuition and General Fee for a 12-month tenure. Preference given to Ph.D. candidates who have completed at least one year of graduate study.

PROCTER AND GAMBLE FELLOWSHIP, $2700 plus tuition and General Fee for a 12-month tenure.

SAGE-TEEPLE FELLOWSHIP IN CHEMISTRY, $2700 plus tuition and General Fee for a 12-month tenure.

TODD FELLOWSHIP IN CHEMISTRY, $2650 plus tuition and General Fee for a 12-month tenure.

UNITED STATES RUBBER COMPANY FOUNDATION POSTGRADUATE FELLOWSHIP, $2000 plus tuition and General fee.

DUPONT TEACHING ASSISTANTSHIP, $1200 plus stipend of a teaching assistantship in chemistry, plus tuition and General Fee.

CIVIL ENGINEERING

ELON HUNTINGTON HOOKER FELLOWSHIP IN HYDRAULICS, tuition and General Fee, may be accompanied by some stipend.

McGRAW FELLOWSHIP, tuition and General Fee, may be accompanied by some stipend.

UNIVERSITY FELLOWSHIP, tuition and General fee, may be accompanied by some stipend.

ELECTRICAL ENGINEERING

MICHAEL FARADAY AND JAMES CLERK MAXWELL FELLOWSHIPS OF CORNELL AERONAUTICAL LABORATORY, ranging from $2000 up plus tuition and General Fee. Provision for an additional $600 if recipient is married.

UNITED STATES STEEL FOUNDATION FELLOWSHIP, $1500 plus tuition and General Fee. Provision for an additional $600 if recipient is married.

CHARLES BULL EARLE MEMORIAL GRADUATE FELLOWSHIP, $600 plus tuition and General Fee. This stipend may be supplemented in special cases.

GEOLOGY AND GEOGRAPHY

ELEANOR TATUM LONG FELLOWSHIP, $1500 plus tuition and General Fee.

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

FREDERICK W. LANCHESTER FELLOWSHIP OF CORNELL AERONAUTICAL LABORATORY, $2000 or more plus tuition and General Fee. Provision for an additional $600 if recipient is married.

SUN OIL FELLOWSHIP, $2250 plus tuition and General Fee. A $500 allowance is available if recipient is married and has one or more children.

GLOBE-UNION CORPORATION FELLOWSHIP, $2000 plus tuition and General Fee.

MATERIALS SCIENCE AND ENGINEERING

J. HEBER PARKER FELLOWSHIP, $2000 plus tuition and General Fee. Restricted to students majoring in Materials and Metallurgical Engineering.

MATHEMATICS

ERASTUS BROOKS FELLOWSHIP, $2200 plus tuition and General Fee.

MECHANICAL ENGINEERING

EDGAR J. MEYER SCHOLARSHIP, $200 or more plus tuition and General Fee.

PROCTER AND GAMBLE FELLOWSHIP, $2000 plus tuition and General Fee. Provision for an additional $700 if recipient is married.

SIBLEY SCHOLARSHIP, $70 plus tuition and General Fee.

UNION CARBIDE FELLOWSHIP, $1800 plus tuition and General Fee. Provision for additional $300 in final year if recipient is married.

PHYSICS

OWENS-CORNING FIBERGLAS FELLOWSHIP, $2000 plus tuition and General Fee. Alternates between the Fields of Physics and Applied Physics.

OTHER FINANCIAL SUPPORT

Prizes

Several University prizes are open for competition to all students, including graduate students. The Committee on Prizes of the University faculty publishes an *Announcement of Prize Competitions,* which may be obtained from the Visitor Information Center, Day Hall.

Two other prizes are open exclusively to graduate students:

THE GUILFORD ESSAY PRIZE. Until at least 1966 a special prize of $120 will be assigned annually to that graduate student who, in the judgment of the Graduate Faculty, writes the best English prose. Each competitor must submit, at or before 12 o'clock of the last Monday in November, specimens of his English prose, preferably prepared as a normal part of his training in candidacy for an advanced degree.

THE PHILOSOPHY PRIZE. A prize of $50 is awarded to the graduate student who submits the best paper embodying the results of research in the Field of Philosophy. The subject of the paper may be historical or critical or constructive. It may be concerned either with problems of pure philosophy or with the philosophical bearing of the concepts and methods of the sciences. Papers must be submitted on or before the first day of May.

Papers submitted in competition for either prize must be typewritten on bond paper (a clean *ribbon* copy), double-spaced, at least 1500 and not more than 5000 words in length, and signed with an assumed name, the real name and address of the competitor being enclosed in a sealed envelope, superscribed with the assumed name. They are to be deposited in the Office of the Graduate School. A student may not submit more than one paper.

Loans

University and National Defense student loans and loans from other sources are available to graduate students enrolled in Cornell University. The actual amount that may be borrowed is based on financial need. Applications should be made to the Office of Student Aid, 105 Day Hall. Applications for New York Higher Education Assistance Corporation Loans may also be obtained from the Office of Scholarships and Financial Aid.

Part-Time Employment

Additional opportunities for part-time work are often available in connection with departmental research projects or other activities. Applications for this type of work should be made directly to the department concerned. If a candidate is employed in research or other work closely allied to his academic interest, he may find such employment valuable.

Progress in candidacy is difficult when a student attempts to support himself wholly or partially by work unrelated to his studies. It usually is sounder economy to borrow from the Office of Scholarships and Financial Aid and keep employment to a minimum. The University maintains a part-time student employment service, however, in that office.

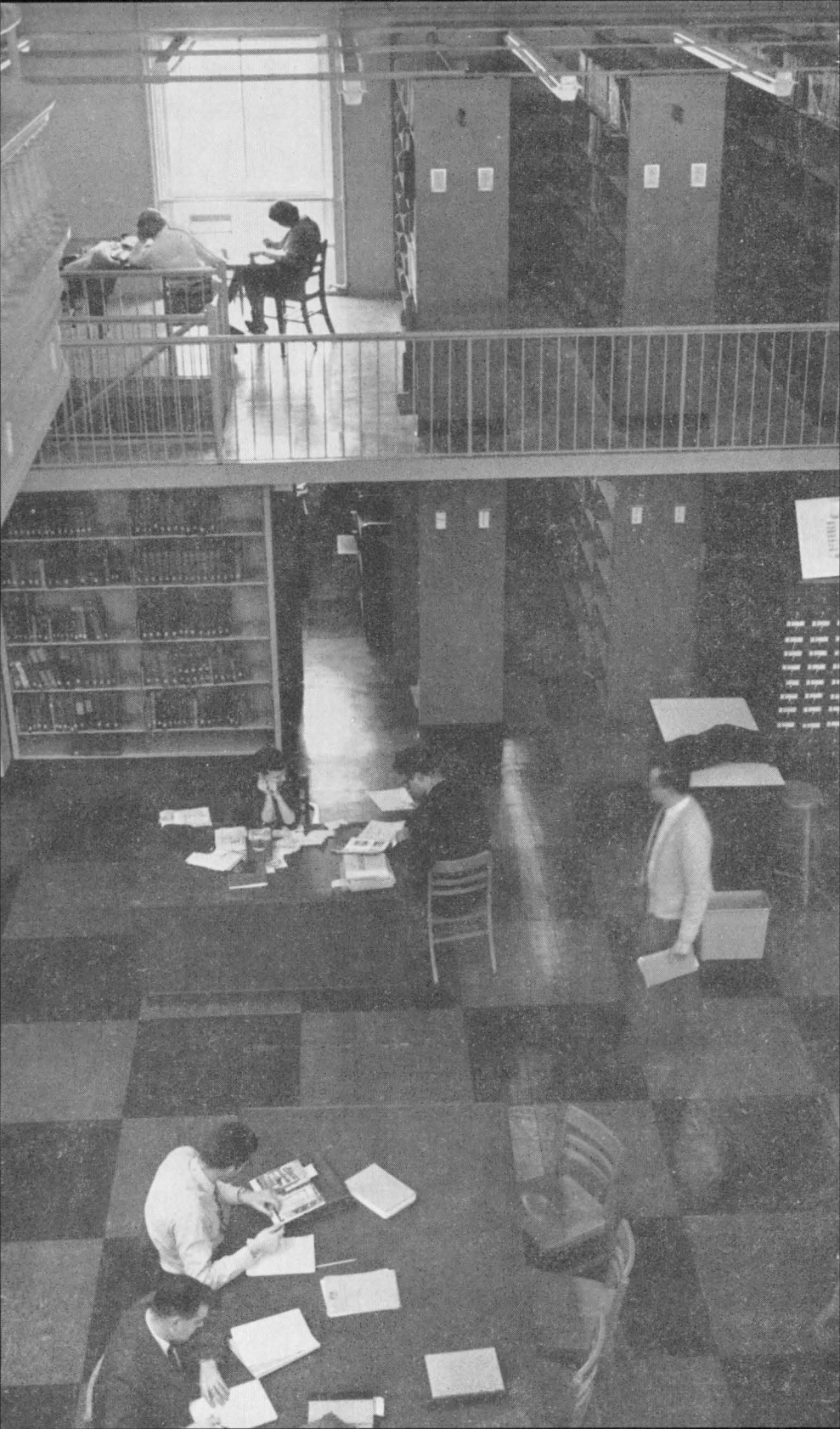
SPECIAL RESOURCES FOR RESEARCH AND ADVANCED STUDY

The descriptions below are limited to major general facilities at the service of graduate students in any of a variety of fields of instruction. In addition, substantial collections and facilities, in many instances unique, have been assembled for the use of graduate students. Although the facilities cannot be described adequately in this Announcement, some of them are mentioned in the statements given under the Fields of Instruction on pages 53–144.

OFFICE OF COORDINATOR OF RESEARCH

The Office of Coordinator of Research is responsible for the submission of all proposals for sponsored projects and for ensuring that these proposals are consistent with Cornell's educational objectives and are in accord with the policies developed at Cornell for research and training programs. A primary function of this office is to give assistance to members of the faculty in the preparation of proposals and to serve as the University's representative for the execution and acceptance of agreements covering the sponsorship of research, training, and service programs by government, industry, and private foundations.

The Office of the Coordinator of Research is responsible to the Vice President for Research and Advanced Studies and works closely with the faculty as well as all University academic and administrative officers and sponsors in an effort to strengthen Cornell's interrelated programs of research, education, and training of graduate students. Coordination of the administration of sponsored projects is accomplished within the normal academic framework of departments, colleges (or schools), and centers.



THE UNIVERSITY LIBRARIES

The University libraries comprise the Central Library (the John M. Olin Library and the Uris Library); the Mann Library of Agriculture and Home Economics; the libraries of the following colleges and schools: Business and Public Administration, Engineering, Fine Arts, Hotel, Industrial and Labor Relations, Law, Medicine (New York City), and Veterinary; such special libraries as the libraries of the Cornell Aeronautical Laboratory and the Geneva Experiment Station; as well as a group of special departmental libraries. The total holdings of the libraries exceed 2,600,000 items, and about 175,000 volumes are being added annually.

Olin Library, completed in 1961, is designed primarily as a research library to serve graduate students and members of the faculty. Adjacent to Olin Library is the former University Library building which was remodeled to serve undergraduate students. Now named Uris Library, it opened in September, 1962.

Four of the campus libraries — Business and Public Administration, Engineering, Industrial and Labor Relations, and Veterinary — recently moved into spacious and attractive new quarters in Malott Hall, Carpenter Hall, Ives Hall, and Schurman Hall respectively. These libraries now contain ample space for the growth of their collections and convenient and comfortable accommodations for readers.

The University libraries not only provide the reference and collateral reading materials necessary for the support and enrichment of teaching and research but also have extensive collections of rare books, newspapers, maps, documents, manuscripts, and microtexts. Especially enriched by the early acquisitions of Cornell's first president, Andrew D. White, and by the first librarian, Willard Fiske, the libraries possess special collections of rare books and manuscripts in many of the fields of graduate study.

The Department of Rare Books in Olin Library houses unique collections, among them books and manuscripts relating to Wordsworth, Dante, Petrarch, and Joyce; the Noyes Collection of American historical documents; the Witchcraft Collection; documents of the Lafayette family and the French Revolution. Olin Library also houses the Wason Collection on Southeast Asia and the Icelandic Collection. Of special note in the History of Science Collections are the Adelmann Collection of embryology and anatomy and the library of the French scientist, Lavoisier.

The Collection of Regional History and the Cornell University Archives constitute a manuscript depository which is expanding at the rate of 500,000 manuscripts a year. In 1965 the holdings totaled more than fourteen million items. These manuscripts relate to all aspects of the economic, political, and social history of this region and areas connected historically with it, and to all aspects of the development of Cornell University.

Many of the College and department libraries also contain materials

The Fine Arts Library, one of the many specialized research facilities of the University.

unique in their fields. Curators and reference librarians in all libraries work closely with graduate students and faculty to afford the best possible assistance in their research.

INTERNATIONAL STUDIES PROGRAMS

Center for International Studies

The Center for International Studies supports and co-ordinates Cornell University's exceptional combination of resources for graduate study and research in contemporary international affairs. It serves to link together the activities of the specialized programs, to stimulate new research and development, and to advise and assist the University on contract commitments abroad sponsored by government or private agencies.

At Cornell the graduate student is offered substantial facilities for international studies in a wide variety of fields, including the physical and biological sciences. Active programs of instruction or research on the problems of foreign areas and international relations are found not only in the relevant social and humanistic studies, but also in such fields as agriculture, veterinary medicine, nutrition, engineering, regional planning, industrial and labor relations, business and public administration, education, home economics, law, and other fields. Cornell University is in a unique position to apply to international problems many diverse disciplines whose urgent relevance is too often disregarded.

The Center for International Studies, as such, does not have a separate faculty of its own nor does it offer courses of instruction. Instead, Center-sponsored projects and research activities, as well as the various programs and committees associated with the Center, draw on the participation of the University faculty. In addition, the Center brings to Cornell visiting faculty, postdoctoral research fellows, and distinguished academic and professional personnel in the area of international affairs.

Services to graduate students include provision of information regarding research activities in international studies both on and off campus, and the opportunity to participate in Center-sponsored faculty research projects. Among the latter are the Modernization Workshop, which studies the process of modernization in developing societies, and a faculty study group on problems of disarmament and arms control. Fellowships and assistantships in international studies may be obtained from the several relevant fields, or support may be secured through National Defense Education Act Fellowships or other sources outside Cornell. In addition, two predoctoral research fellowships in international studies are offered annually by the Graduate School upon the recommendation of the Center for International Studies.

The student interested in a particular foreign area or in particular international problems may find that the faculty of his own major discipline includes specialists qualified to provide appropriate instruction

or supervision. Or the student may wish to major or minor in one of the relevant functional fields of international studies recognized by the Graduate School, such as anthropology, comparative government, international relations, international law and organization, sociology, international and comparative labor relations, international economics and the economics of development, agricultural policy and economic development, international and foreign operations, and international legal studies. The student seeking a specialized knowledge of a foreign area may work in one of the three major interdisciplinary graduate areas and language programs on China, South Asia, Southeast Asia, and Latin America. In all of them Cornell has outstanding facilities in staff, library, and other resources in a broad range of disciplines: in the International Agricultural Development Program; in the International Population Program; in African or Soviet studies (under the guidance of faculty committees); or in major or minor subjects in history, linguistics, or a foreign literature.

The offices of the Center for International Studies are in Rand Hall. Further information may be obtained from Professor Steven Muller, Director, 216 Rand Hall.

African Studies

ADVISORY FACULTY COMMITTEE ON AFRICAN STUDIES: V. W. Turner, Chairman; D. Ashford, W. Friedland, M. R. Konvitz, A. Leighton, C. Morse, S. Muller, T. Poleman.

Cornell University has substantial facilities for graduate study and research on Africa. Many members of the faculty in a variety of fields are qualified by research experience in Africa to provide instruction or guidance to students who wish to specialize in some aspect of African studies, who plan to work there, or who are interested in a general or comparative knowledge of the area. Instruction and training in general linguistics are available for students expecting to deal with tribal peoples, and special courses on particular African languages (e.g., Ibo, Yoruba) have been given in recent years. Courses are regularly offered on the cultures and social systems of Africa and on the problems of economic, political, and social development of the area. The University libraries provide a good working collection of books, documents, maps, newspapers, and periodicals on Africa of sufficient scope to enable students and staff to carry on regional research. A representative group of African students is attracted to Cornell each year, most of whom are eager to discuss African life and problems with interested students from other areas.

China Program

FACULTY: H. Shadick, Chairman; K. Biggerstaff, N. C. Bodman, J. W. Lewis, T. C. Liu, H. C. Mills, A. P. Wolf, M. W. Young.

The China Program provides comprehensive graduate-level training and sponsors a wide range of research. To achieve these ends the Program has brought together eight China specialists: professors in the fields of anthropology, economics, government, history, history of art, language and literature, and linguistics.

Graduate students in the Program take a major in one of the subjects listed above. They are expected at an early stage to attain sufficient mastery of the Chinese language to permit use of Chinese sources in their courses and seminars and in their research.

The focus of much of the research and teaching in the Program is the society, polity, economy, culture, and arts of modern and contemporary China. Students with this concentration are also expected to develop a general knowledge of traditional institutions and culture. Students majoring in history concentrate on nineteenth- and twentieth-century China; no chronological limits apply to those in the history of art, linguistics, or literature.

Several China Program fellowships are offered each year to first-year graduate students. They carry stipends of up to $2,700 plus tuition and fees. Research assistantships are available from time to time. London-Cornell Studentships are open to advanced Ph.D. candidates in the social sciences (including modern institutional history) who are in the China Program. They are tenable for study during an academic year at the London School of Economics and Political Science or at the School of Oriental and African Studies of the University of London. Stipends range up to $3,000 plus air fares and tuition and fees.

London-Cornell Field Research Grants are open to Ph.D. candidates in the social sciences (including modern institutional history) who are in the China Program. They are tenable for up to 22 months for the purpose of dissertation research. London-Cornell Field Research grantees may conduct their field work in any part of East Asia where Chinese communities or materials on modern and contemporary China are accessible. Stipends range up to $12,000 for 22 months, including travel and research expenses.

National Defense Foreign Language Fellowships and Foreign Area Training Fellowships are tenable in the Program. Graduate students may also apply for other assistantships, fellowships, and scholarships offered by the University and by its departments.

Additional information on the Program and the various fellowships and awards may be obtained by writing to the Director, China Program, Franklin Hall.

International Agricultural Development Program

Cornell University provides unusual scope and facilities for graduate-level study and research concerning development of the critical agri-

cultural sector of newly developing nations. An integrated program of research and graduate training is available in the various biological, physical, and social science fields which are relevant to agricultural development. All fields of study in the New York State College of Agriculture at Cornell University have faculty members with intensive foreign experience and students training for overseas work.

A student preparing for work in International Agricultural Development majors in a specific field. In addition to basic preparation in that Field, he will minor in the Field of International Agricultural Development. The student may follow courses which help him in applying his knowledge to the special conditions of newly developing nations, consult with experienced faculty members in regard to such application, and pursue a research project for his dissertation which is relevant to the special problems of newly developing countries. In much of this work the program in agriculture draws upon the strong international programs in other colleges of the University, including the area study programs and the extraordinarily varied offerings in modern languages and linguistics.

Faculty experience in overseas work is continuously developed through work on College overseas programs, individual consulting assignments, and the ongoing research of faculty members and their students. The environment for the International Agricultural Development Program is further enhanced by more than 200 foreign graduate students majoring in the various fields represented by the College of Agriculture.

Substantial expansion has recently taken place in the international program of the three rural social science departments — agricultural economics, rural education, and rural sociology. In addition to nineteen regular faculty members with extensive overseas experience, several members of these departments devote themselves full time to research and teaching in international agricultural development; they have built special programs of research and continuing contact with particular geographic areas. The three departments have a number of assistantships designed to finance graduate students while they work closely with the teaching and research program in international agricultural development. Doctoral candidates in these departments who are interested in international agricultural development are expected to do field research in newly developing countries for their doctoral dissertations. Emphasis in field research lies largely in Latin America, Southeast Asia, and South Asia.

Similar expansion of international activities is under way in other subject matter areas of the College of Agriculture. At present, most departments in the College also have departmental assistantships which are open to outstanding students in those departments.

Additional information may be obtained by writing to Professor K. L. Turk, Director, International Agricultural Development Program, Roberts Hall.

International Legal Studies

A program of concentrated study in the international legal field is offered. The Ford Foundation in 1956 made a substantial grant to the Law School to be spent during the following ten years principally in conducting faculty seminars in the field of comparative law and summer conferences in the field of public international law. In addition, the Center for International Studies sponsors a limited number of research fellowships in international legal studies, which are awarded by the Graduate School on the joint recommendation of the Center and of the Law School.

For more detailed information, see the current announcement of the Law School, the current Annual Report of the Center for International Studies, and the current issue of "International Studies at Cornell University – Courses of Instruction." Further information may be obtained by writing to Professor Robert S. Pasley, Chairman, Graduate Study Committee, The Cornell Law School, or to Professor Steven Muller, Director, Center for International Studies, 216 Rand Hall.

Latin American Program

FACULTY: J. M. Stycos, Director; F. Agard, S. Barraclough, J. S. Bernstein, D. Brenes, T. Davis, M. Dominguez, C. L. Eastlack, B. L. Ellenbogen, D. Freebairn, R. K. Goldsen, R. Graham, A. R. Holmberg, H. A. Landsberger, J. Morris, D. F. Solá, W. F. Whyte, F. Young.

The Latin American Program of studies enables the graduate student to develop specialized competence in the history, culture, social organization, and language of Latin American countries. By means of a complex of courses drawn from various fields and under the guidance of Latin American specialists, the student majoring in a relevant discipline can minor in Latin American Studies.

Because of the considerable volume of research on Latin America currently being carried out by Cornell faculty members, students will normally be afforded the opportunity of participating in on-going projects while in residence and will generally be expected to do field work in Latin America at some stage of their graduate training.

Additional information may be obtained by writing to Professor J. M. Stycos, Director, Latin American Program, Rand Hall.

Medieval and Renaissance Studies

The Program in Medieval and Renaissance Studies offers opportunities for work on topics, problems, or aspects of medieval and Renaissance civilizations more extensive than those usually treated within a single discipline or within the time limits conventionally observed in a major

subject (as defined on page 52). Plans of study therefore normally include:

1. Concentration in one Field of instruction (see pages 53 ff.), in which the student will become capable of independent work. The student will specify in his application that he wishes acceptance by this Field, not by the program, although he should mention his interest in the program; and he will expect to complete all the stated requirements for a major in the Field.

2. Related studies chosen from various disciplines. The members of the Special Committee (see page 10) will advise the candidate less with the aim of making him highly proficient in their own specialties than of increasing his understanding of medieval and Renaissance civilization as a whole.

3. A thesis involving relations between various areas and periods, rather than matters customarily studied within the limits of any one of them.

In addition to fellowships and scholarships offered by the Graduate School to all students (see page 20) and in addition to assistantships in some departments, the George Lincoln Burr Fellowship is available to candidates in the program (see page 23). Applicants for it should mention it on the usual fellowship forms and should also send notice of having done so to the Chairman, Committee on Medieval and Renaissance Studies, Goldwin Smith Hall. Inquiries or requests for further information should be similarly addressed.

Near Eastern Studies

ADVISORY FACULTY COMMITTEE ON NEAR EASTERN STUDIES: J M. Cowan, Chairman; A. H. Detweiler, A. E. Kahn, S. A. McCarthy, I. Rabinowitz.

Students wishing to relate the work of their major or minor subjects to Near Eastern area or language studies should seek advice or information from the Faculty Committee on Near Eastern Studies. In a number of fields, the University's resources for specialized graduate study and research on countries of the Near East are of considerable value. Members of the Committee can provide suggestions regarding relevant courses in various subjects, assistance in planning research on the Near East, and guidance in applying for area training or research fellowships. Inquiries should be addressed to Professor J Milton Cowan, Director, Division of Modern Languages, Morrill Hall.

South Asia Program

(Bhutan, Ceylon, India, Nepal, Pakistan, Sikkim)

STAFF: M. E. Opler, Director; Messrs. L. P. Adams, D. E. Ashford, A. C. Atwell, J. W. Bordie, H. R. Capener, A. T. Dotson, G. H. Fair-

banks, H. Feldman, J. Gair, G. Kelley (on leave 1965–66), K. A. R. Kennedy, J. W. Mellor, S. J. O'Connor, R. A. Polson, M. L. Sill.

The increasing importance of the peoples of the Indian subcontinent and of the role they play in world affairs enhances the need for providing opportunities in America for training and research in the field of Indic studies. The South Asia Program at Cornell, dealing primarily with India, Pakistan, Ceylon, and Nepal, is organized and equipped to help meet this need. Since 1948 it has sponsored a series of research projects on India and Ceylon, and it has trained a distinguished group of younger American and South Asian scholars in South Asian area and language studies. The program faculty includes members from agricultural economics, anthropology, art, government, history of art, child development and family relationships, business and public administration, rural sociology, industrial and labor relations, and languages. Sanskrit, Pali, Hindi, Urdu, Telugu, and Sinhalese are languages regularly offered at Cornell. Arrangements may be made for the intensive study of other South Asian languages at summer institutes held on different American university campuses each year.

Qualified graduate students interested in specializing in the study of South Asia minor in Asian Studies with concentration on South Asia, in South Asian art history, or in South Asian linguistics. Advanced degree requirements for this minor are roughly comparable in terms of South Asian materials to those for the Southeast Asia concentrations given below. The doctoral candidate must have a reading knowledge of Hindi or, depending upon the subarea of his specialization, some other important language of South Asia.

RESEARCH AND FIELD TRAINING

The doctoral dissertations of students in the South Asia Program are normally based on research done in India, Pakistan, Ceylon, or Nepal. Students' field research may benefit from the advice and guidance in the field of a program staff member. At least one member of the faculty of the South Asia Program has been in South Asia for each of the last several years. Cornell is a charter member of the American Institute of Indian Studies, which was organized to facilitate study and research in India by American advanced students and by faculty specializing on various aspects of Indian civilization and contemporary affairs. The University also maintains close links with a number of research agencies, programs, and institutions of higher learning, such as the Deccan College Linguistic Program. Staff members of these institutions have provided valuable assistance to Cornell students working in India. Opportunities exist for graduate students to become associated with Cornell-sponsored research in South Asia or to carry on independent research abroad. Every effort is made by the program staff to aid qualified students to obtain financial support for a field training or research project in one of the countries of the area.

Research interests under the South Asia Program are focused largely on recent or contemporary developmental problems of the countries of the area — on changes taking place in the economic, political, social, religious, artistic, and intellectual life of the region. A long-term research project in progress in India is primarily concerned with the ramifying problems of introducing technological changes and the influence of such changes when adopted. For this research program, faculty and students in anthropology have carried on, since 1949, an extended and varied series of rural and urban community studies in several different regions of India from the Deccan into the Himalayan foothills. A major related project, the Cornell International Agricultural Development Program, which is supported by Ford Foundation funds, is concerned with the development of the entire agricultural sector of the Indian economy. At the same time other studies in urban renewal and regional planning, public administration, the role of government in cultural change, and recent movements in the arts and in religions and ideologies are in process under faculty direction. Cornell is also making a special study of the Sinhalese language and of linguistic problems of Ceylon, a nation so far much neglected by American scholars. Research is also under way on Oriya, an important regional language of eastern India. The new nations of South Asia present so many problems for study that the areas of inquiry open to students and staff members are limited only by availability of research means.

FELLOWSHIPS AND ASSISTANTSHIPS

Fellowship and assistantship awards are available to qualified graduate students minoring in Asian Studies with a concentration on South Asia. The South Asia Program awards fellowships to incoming graduate students with South Asia interests. Students in the South Asia Program are also eligible for assistantships in their major discipline departments, for fellowships and scholarships offered by the Cornell Graduate School, for National Defense Foreign Language Fellowships, and for Foreign Area Training Fellowships. Additional information on financial aid may be obtained by writing to the Director, South Asia Program, White Hall, Cornell University.

Southeast Asia Program

FACULTY: J. M. Echols, F. H. Golay, D. G. E. Hall, R. B. Jones, Jr., G. McT. Kahin, N. G. M. Luykx II, S. J. O'Connor, R. A. Polson, L. Sharp, J. T. Siegel, O. W. Wolters, J. U. Wolff.

The Southeast Asia Program possesses substantial facilities for study and research on the graduate level and provides exceptional opportunities for general or specialized work on all of Southeast Asia in various disciplines of the humanities, social sciences, and some natural sciences, as well as in interdisciplinary area seminars. Much basic and pioneering research remains to be done in this area, and the Southeast Asia Program is organized and equipped to help meet such needs.

Southeast Asia Program fellowships are available on a competitive basis to graduate students. These carry stipends of up to $2700, plus tuition and fees, and are available only to qualified candidates for advanced degrees at Cornell. Competition for these awards is open to citizens of the United States or Canada, nationals of Southeast Asian countries, and, in exceptional cases, nationals of other countries.

These awards are available to applicants who are able to demonstrate a serious scholarly interest in Southeast Asian studies; who show the greatest promise of becoming qualified regional experts with specialization in a relevant discipline of the humanities, social sciences, or certain natural sciences; and who are admitted to the Cornell Graduate School for advanced work in such a discipline. Previous experience in Southeast Asia or in the study of that area is not necessarily required. It is important that the applicant be able to show that advanced work in a major subject offered at Cornell, combined with work in the Southeast Asia Program, will make his future professional activities more effective; this requirement is particularly important for a student in the natural sciences.

Fellowships are normally awarded for one academic year. Where the student's work during the first year has been of high caliber, reappointment is sometimes possible. In such cases, formal reapplication is expected from the student. The primary purpose of these awards is to encourage graduate students to acquire a substantial knowledge of Southeast Asia while majoring in one of the discipline Fields of the Graduate School. Accordingly, they are usually offered only to students who take a minor in Asian Studies and participate fully in the Southeast Asia Program. The recipient of a fellowship may be asked to devote up to six hours a week under faculty supervision to work connected with the Program.

London-Cornell Studentships are available for advanced Ph.D. candidates in the social sciences (including modern institutional history) who have already had at least one year of resident study in the Southeast Asia Program. These fellowships are tenable for study during an academic year at the London School of Economics and Political Science or at the School of Oriental and African Studies in the University of London. Stipends range up to $3000 plus air fares and tuition and fees. London-Cornell field research grants are open to Southeast Asia Program Ph.D. candidates in the social sciences (including modern institutional history) after they have had appropriate training at Cornell, or at Cornell and London. They are tenable for up to 22 months for the purpose of dissertation research. Recipients of London-Cornell field research grants may conduct research in any part of Southeast Asia. Stipends range up to $12,000 for 22 months including travel and research expenses.

National Defense Foreign Language Fellowships, Title VI, are offered by the United States Office of Education and application should be made to the Sage Graduate Center, Cornell University. Foreign Area Training Fellowships, administered by the Social Science Research Council, may be obtained by writing to the Foreign Area Fellowship

Program, 444 Madison Avenue, New York, New York 10022. Graduate students may also apply for other assistantships, fellowships, and scholarships offered by the University and its departments.

Additional information on the Program and the various fellowships and awards may be obtained by writing to the Director, Southeast Asia Program, Franklin Hall.

Soviet Studies

COMMITTEE ON SOVIET STUDIES: M. G. Clark, Chairman; U. Bronfenbrenner, G. Fischer, J. Fisher, G. Gibian, R. L. Leed, W. M. Pintner, G. Staller.

OTHER FACULTY MEMBERS IN SOVIET STUDIES: P. Carden, M. Horwitz, A. Jaryc, A. Lipson, H. Olmstead.

The University offers a number of courses and seminars on the Soviet Union as well as Imperial Russia. Instead of a separate area program, graduate students have a choice of majors and minors in the established Fields of the Graduate School. Some of the subjects focus on area specialization: Russian history, Russian literature, Slavic linguistics. Other subjects combine area specialization with a nonarea framework: comparative government, economic planning, regional planning, social psychology.

Graduate students pursuing Soviet Studies in any of these subjects are expected to attain proficiency in the Russian language either before entering the Graduate School or soon thereafter.

The University's academic activities related to Russia are coordinated by the Committee on Soviet Studies. The Committee also sponsors a colloquium for faculty members and graduate students in Soviet Studies. In the Soviet Studies Graduate Study in the John M. Olin Library, major reference works and key current periodicals from and about the U.S.S.R. are brought together.

The Committee on Soviet Studies selects a limited number of graduate students each year as research assistants. The Russian section of the Division of Modern Languages also appoints several graduate students annually as teaching assistants in the Russian language. For other teaching assistantships, fellowships, and scholarships, students apply directly to the Graduate School or the Department concerned. N.D.E.A. Title IV and Title VI fellowships are available in various subjects.

Inquiries about these fellowships and other aspects of Soviet Studies should be addressed to Professor M. Gardner Clark, Chairman, Committee on Soviet Studies, 263 Ives Hall.

OTHER PROGRAMS AND CENTERS

Center for Aerial Photographic Studies

Photographic interpretation has applications in agriculture, engineering, geology, and city and regional planning. The Center for Aerial

Photographic Studies offers a broad program in various scientific fields for training personnel in aerial photographic interpretation. The objectives are, first, to train scientists who will be able to use aerial photographs for surveys and planning in fields where they are needed and, second, through research to extend the use of aerial photographs into all fields which can be benefited.

The Center comprises a staff of educators, scientists, and technicians experienced in research and the application of aerial photographs to their respective fields. The program consists of primary courses in interpretation of aerial photographs, map reproduction, photogrammetry, cartography and map projections, together with specialized study in a particular field of the candidate's choice, such as agricultural development, national resource explorations, city planning, or engineering project planning.

For more information, write to the Director, Center for Aerial Photographic Studies, Hollister Hall.

Center for Housing and Environmental Studies

The purpose of the Center for Housing and Environmental Studies is to aid and guide basic research in the field of man's shelter and environment, to facilitate graduate study, to aid the flow of information among colleges and departments and between the University and sources of information off campus. A small central staff assists in the initiation and conduct of projects.

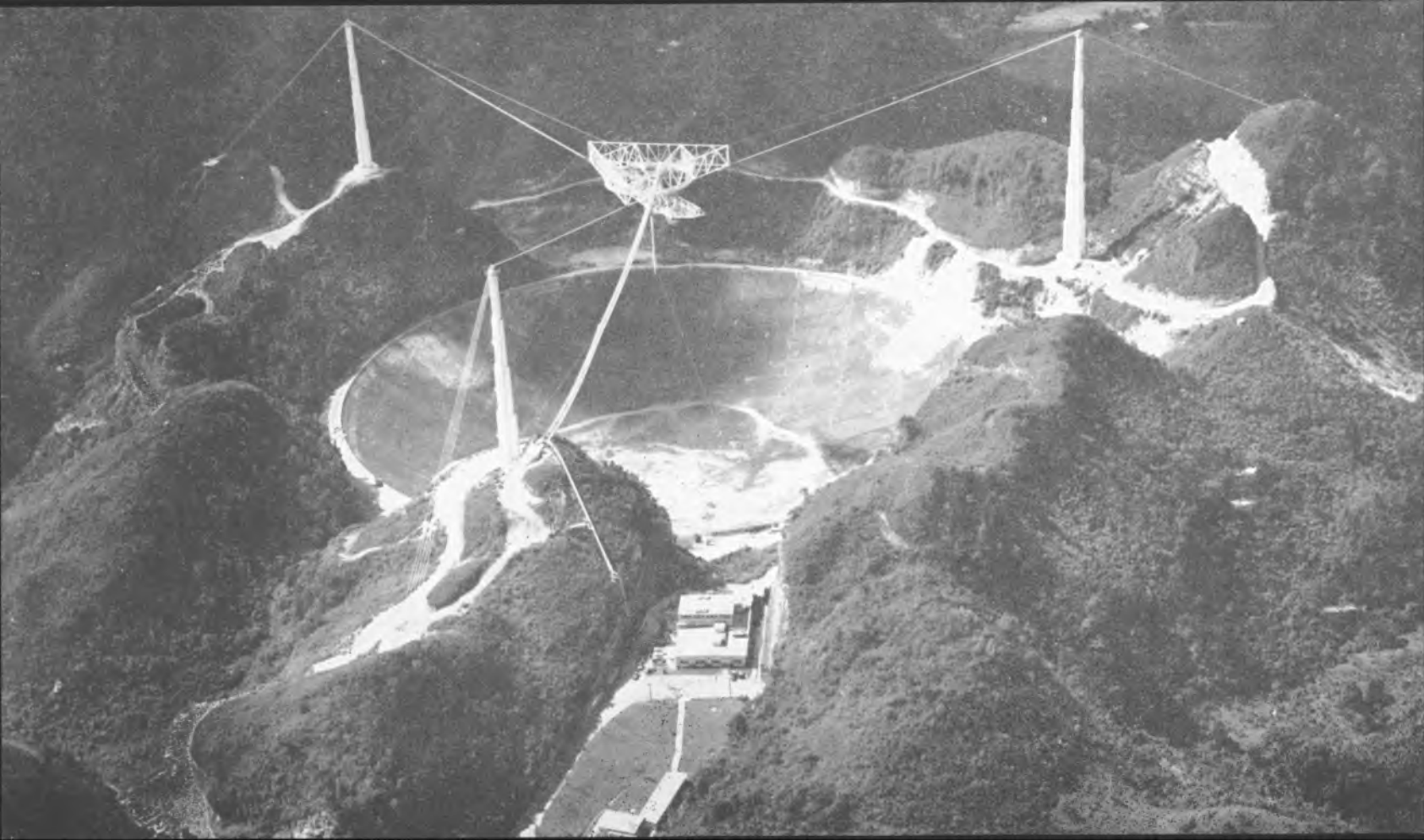
The facilities of the Center for Housing and Environmental Studies are available to faculty members and graduate students in all Fields. Through the Center, students who cut across traditional lines of research may draw upon the knowledge and experience of specialists in such various subject areas as design, materials, equipment, structural methods, environment, family living, economics and finance, government, and health. The Director of the Center is Professor Glenn H. Beyer, West Sibley Hall, and the Assistant Director is Myron H. Levenson.

To facilitate and encourage interdisciplinary research on urban problems there is a Division of Urban Studies within the Center. The Division is available to assist faculty and students in all departments of the University with their research interests which deal in any way with studies of the nation's and the world's rapidly expanding urban populations and areas. The program of the Division is directed by Professor Barclay G. Jones, Associate Director of the Center, West Sibley Hall.

Center for Radiophysics and Space Research

The Center for Radiophysics and Space Research unites research and graduate education carried on by several academic departments in

The "Big Dish" Observatory at Arecibo, Puerto Rico.



the space sciences. It furnishes administrative support and provides facilities for faculty members and graduate assistants who are engaged in space research activities, and it offers opportunity for graduate students to undertake thesis work leading to the degrees of Master of Science and Doctor of Philosophy. A student's major professor can be chosen from the following Fields in the Graduate School: Aerospace Engineering, Astronomy and Space Sciences, Electrical Engineering, Applied Physics, Physics.

Thesis research in the following areas is now possible:

(a) Astronomy and Astrophysics. Astronomical aspects of cosmic rays, gamma-radiation, X-rays, neutrinos; cosmology; experimental studies and theory relating to the surface of the moon and the planets; processes in the interstellar gas; solar-system magnetohydrodynamics; stellar statistics; theory of stellar structure, stellar evolution, nuclear processes in stars.

(b) Atmospheric and Ionospheric Radio Investigations. Dynamics of the atmosphere; incoherent electron scattering; study of refraction, scattering, attenuation due to the inhomogeneous nature of the troposphere and ionosphere; theory and observation of propagation of radio waves in ionized media such as the ionosphere.

(c) Radar and Radio Astronomy. Distribution and classification of radio sources; radar investigations of the moon and planets; solar radio observations; studies of gaseous nebulae.

(d) Space Vehicle Instrumentation. Instrumentation relating to lunar exploration; magnetic field measurements; tenuous gas and particle flux measurements; infrared observations from rockets.

The facilities of the Center include the lunar surface and electronics laboratory on the Cornell campus, the radio astronomy and ionospheric laboratories close to Ithaca, and the Arecibo Ionospheric Observatory in Puerto Rico. At Arecibo an extremely sensitive radio telescope and an unusually powerful space radar are available for use by qualified graduate students. In addition, certain facilities of Sydney University, Australia, are available through the Cornell-Sydney University Astronomy Center (see below).

Cornell-Sydney University Astronomy Center

The Center is an interuniversity organization designed to create a larger pool of facilities and skills for research in astronomy and related fields than would be separately available to either university. Graduate students can be interchanged between the two institutions whenever appropriate for the research work in which they are engaged. Both universities recognize research supervision extended by the sister university and the time spent by a student on thesis work in the sister university can be accepted toward residence requirements with the proviso that the approval of the home research supervisor is given and also that the home university bylaws are not contravened.

The facilities which are available through the Center, in addition to those of Cornell's Center for Radiophysics and Space Research, are the 1-mile by 1-mile Mills Cross situated at Hoskinstown, N.S.W., the stellar intensity interferometer situated at Narrabri, N.S.W., the Criss-Cross, the Shain Cross, and Mills Cross situated at Fleurs, N.S.W., the Wills Plasma Physics Department, the Basser Computing Department, the Falkiner Nuclear Department, and the facilities of the cosmic ray group at the University of Sydney. The Center includes H. Messel, R. Hanbury Brown, W. N. Christiansen, C. B. A. McCusker, and B. Y. Mills from the University of Sydney faculty.

Further information can be obtained from Professor T. Gold, Joint Director, Cornell-Sydney University Astronomy Center, Clark Hall.

Computing Center

The Center is equipped with a Control Data Corporation 1604–160A Computing System with eight magnetic tape units, 1200-cards-per-minute reader, 1000-lines-per-minute printer, card punch, and plotter. In addition a variety of Unit Record Equipment is also available.

The Center is designed to service the instructional and research needs of the University. It is divided into three service areas: key-punching, programing, and computer operations. Funded research is expected to pay the appropriate costs for the services requested. Non-funded research personnel is allowed limited use of the equipment with the expectation that users perform all services except computer operations. Consulting is offered to determine project feasibility and/or cost as well as for programing.

The staff consists of several research associates acting in a consulting capacity as well as professional staff and the necessary technical and operating personnel. As many as seven graduate assistants act as consultants in their field of activity. In addition numerous undergraduates are employed part-time to supplement the programing and operating staff.

For further information about the Computing Center, write to the Director, Computing Center, Rand Hall.

Materials Science Center

The Materials Science Center (MSC) at Cornell is an interdisciplinary laboratory created to promote research and graduate student training in all phases of the science of materials. The subjects of study represented in the MSC program are chemistry, electrical engineering, materials engineering, materials science, applied physics, metallurgy, and physics.

The extent of the benefits a graduate student may derive from the MSC program depends on the actual research he pursues. If the student chooses to follow the more conventional course of becoming a specialist

in one specific area, some of the ways the MSC program could help him would be to provide new equipment; to provide, in some cases, the help of a technician to carry out routine measurements; and to provide financial assistance through research assistantships.

If the student wishes to follow a program of considerably more breadth than usual in his research training, the MSC program provides an additional advantage. Several central facilities have been set up where more specialized apparatus such as crystal-growing furnaces, high-pressure equipment, X-ray and metallography equipment, electron microscopes, etc., are available to all MSC members and their students. In addition to the equipment, expert advice on its use and the interpretation of the results will be available. In these central facilities, it is expected that the student will come in contact with students from other disciplines, resulting in a mutually profitable interaction.

The office of the Director of the Materials Science Center is in the Clark Hall of Science.

Social Science Research Center

The Center is an organization designed to encourage and facilitate research in all major fields of the social sciences and to promote, whenever desirable and feasible, interdisciplinary cooperation in program development and research endeavor. Its services are available to individual faculty members and organized staff groups in all schools and colleges of the University. Apart from a limited program of direct financial support, the Center services involve assistance in planning and development of programs and research projects. The Center does not itself engage in research, however, nor directly provide technical services. Rather, with minor exceptions, its assistance takes the form of bringing together persons of similar interests or of channeling inquiries and problems to appropriate campus agencies and individuals.

Services to graduate students in the past have assumed varied forms, including provision of information regarding research activities, both on and off campus, and a program of limited grants-in-aid to advanced graduate students. For the most part, however, as a facilitating rather than operating agency, the Center's services to graduate students have been indirect. A major benefit has been the opportunity for graduate students to participate in certain of the Center-sponsored workshops and faculty seminars. Inquiries concerning present programs and services should be addressed to the Center offices, which are located in the Industrial and Labor Relations Research Building.

Statistics Center

The methods of statistics find important applications in many diverse fields of research. It is therefore necessary that (1) subject matter spe-

cialists be able to obtain assistance in using or developing statistical theory, (2) students who intend to do research in a particular field which makes extensive use of statistical methods receive adequate training in statistics, and (3) individuals be trained as statisticians.

The staff members of the various schools and colleges of Cornell University who are interested in the development and application of statistical methods are associated with the Cornell Statistics Center. A major responsibility of the Center is to provide a focal point to which individuals, projects, and departments may come to receive assistance and guidance with respect to the statistical aspects of research and training programs.

The Acting Director of the Center is Professor Philip J. McCarthy, Ives Hall.

Water Resources Center

The Center serves to encourage interdisciplinary graduate study and research in the comprehensive aspects of water resource planning, development, and management. It brings together staff members with individual interests in the many specialized areas and with a common interest in a multidisciplinary approach to graduate education in water resources.

This organization promotes and coordinates activities and services related to water resources at Cornell; it fosters and stimulates new courses, curricula, and research in the water resource related areas of agriculture, conservation, economics, engineering, and law and in the comprehensive aspects that integrate these specialty areas into the whole.

See also the section on the Field of Water Resources, page 142.

Correspondence concerning the Center should be directed to Professor L. B. Dworsky, Director, Water Resources Center, Hollister Hall.

Correspondence related to graduate study in the Field of Water Resources should be directed to the Field Representative, Professor C. D. Gates, Hollister Hall.

SPECIAL FACILITIES AND SERVICE ORGANIZATIONS

Cornell Aeronautical Laboratory

The Laboratory, a separate corporation wholly owned by Cornell University, is in Buffalo, New York. Applied and fundamental research in the aeronautical sciences and allied areas is conducted in this completely equipped laboratory under contracts mainly with the military services. Close relationships, both research and educational, are maintained with the campus in Ithaca.

New York State Agricultural Experiment Station at Geneva

The New York State Agricultural Experiment Station was established in 1880 to promote agriculture through scientific investigations and experimentation. It is located at Geneva, 50 miles from Ithaca, and has been under the administration of Cornell University since 1923.

Professors on the Geneva staff are eligible to serve as members of the Special Committees of graduate students along with professors on the Ithaca campus of the University. Normally the graduate training provided at Geneva consists of research experience and supervision of the student's work on a thesis problem. The formal course work part of the student's training program is given on the Ithaca campus. Students who plan to do part of their graduate work at Geneva should correspond with their major advisers or with the Dean of the Graduate School concerning regulations as to residence, Special Committees, etc.

The Station is equipped to care for graduate students in certain specific lines of research, viz., bacteriology, chemistry, economic entomology, food technology, plant pathology, pomology, seed investigations, and vegetable crops. Ample facilities are available for graduate research under laboratory, greenhouse, pilot plant, insectary, orchard, and other field conditions.

Certain phases of the investigations now being conducted at the Station and other problems for which the facilities of the Station are suitable may be used as thesis problems by graduate students.

The Director is Professor D. W. Barton, who may be addressed at the New York State Agricultural Experiment Station, Geneva.

Publication and Photography

Cornell University Press, founded by Andrew D. White in 1869, is the oldest university press in America and is among the leaders in number of volumes published annually. The Press publishes scholarly books on nearly every academic subject, serious nonfiction of general interest, and advanced or experimental textbooks for use in universities. The imprint of Comstock Publishing Associates, a division of the Press, is placed on certain books in the biological sciences. The Press also publishes a distinguished paperbound series, Cornell Paperbacks.

The University owns and operates the Photo Science Studios, which create or cooperate in the creation of photographic studies and visual aids of all kinds.

The extension services of the New York State Colleges, which form integral parts of the University, disseminate knowledge through an intensive program of publication, photography, and recording supervised by professional staffs. Materials of graduate students may find an outlet through these channels.

Other Research Units

Some other research units allied with the University, either as wholly owned and operated divisions or as wholly or partially autonomous organizations with which the University has a working agreement, are the Sloan-Kettering Cancer Research Institute (in New York City, through the Graduate School of Medical Sciences), the Veterinary Virus Research Institute (at Ithaca), and the Brookhaven National Laboratory (Cornell is one of nine university trustees under contract with the Atomic Energy Commission).

In addition, opportunities for formal study, field work, and independent research by Cornell graduate students are available in many institutions, laboratories, and libraries both in the United States and in other countries. For example, the Cornell-Harvard Archaeological Exploration at Sardis, Turkey, and the Museum of Northern Arizona at Flagstaff, Arizona, both provide opportunities for field research related to doctoral work of Cornell graduate students. Information on this kind of arrangement is available directly from the Feld Representatives.

FIELDS OF INSTRUCTION

The Fields of Instruction in the Graduate School are listed alphabetically below under four Areas: Humanities, Social Sciences, Biological Sciences, and Physical Sciences. For each of the Fields there are listed the respective faculties, approved major and minor subjects, language requirements for the Master's degree (if any), and special requirements or policies of the Field.

In most instances the Field coincides with a department in a college or school at Cornell. In parentheses immediately following the name of the Field is given an abbreviation indicating the Announcement (catalog) * of the school or college which contains descriptions of courses and seminars offered, as follows: Ag., New York State College of Agriculture; Arch., College of Architecture; Arts, College of Arts and Sciences; B.P.A., Graduate School of Business and Public Administration; Ed., School of Education; H.E., New York State College of Home Economics; Hotel, School of Hotel Administration; I.L.R., New York State School of Industrial and Labor Relations; Law, Law School; Nutr., Graduate School of Nutrition; Vet., New York State Veterinary College. Because the College of Engineering (Engin.) has two Announcements, prospective graduate students should specify their interest in graduate work and should request the particular engineering Announcement entitled *College of Engineering: Courses and Curricula.*

For registration in courses, see page 16.

MAJOR AND MINOR SUBJECTS

For each Field there is given an approved list of titles from which candidates for advanced general degrees choose major and minor subjects. The numbers 1, 2, 3, 4, 5 have the following meaning:

1, approved as major subject for the Ph.D.

2, approved as major subject for the general Master's degree.

3, approved as minor subject when the major is the same Field.

4, approved as minor subject when the major is in another Field.

5, approved as a minor subject for the Master's degree only.

For explanation regarding language requirements for the Master's degree, see page 15.

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* Announcements of the schools and colleges of Cornell may be obtained by writing to the Announcements Office, Day Hall, or to the Graduate School Office, Sage Graduate Center, Cornell University, Ithaca, New York 14850.

REPRESENTATIVES

Since instruction in the Graduate School is primarily individual, those interested in becoming students are encouraged to communicate with individual members of the faculty with whom they may want to study. Personal interviews in advance of formal application for admission are especially encouraged. For the benefit of those who are not acquainted with appropriate members in the Field or Fields of their interest, each Field has selected a representative to whom inquiries may be addressed.

HUMANITIES

Architecture (Arch.)

Faculty: L. D. Brown, T. H. Canfield, A. H. Detweiler, R. A. DiPasquale, S. W. Jacobs, B. G. Jones, C. F. Rowe, F. W. Saul, S. W. Stein, F. M. Wells.

Field Representative: C. F. Rowe, 156 E. Sibley Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Architectural History 1, 2, 3, 4 Architectural Structures 2, 3, 4

Applicants for graduate work in History and Structures are expected to submit their scores on the Graduate Record Examinations (Verbal and Quantitative).

ARCHITECTURAL HISTORY. Language requirement for the Master of Arts degree in Architectural History: proficiency in French, German, or Russian before the completion of second residence unit.

Admission to the graduate program in Architectural History is normally limited to candidates for the Master of Arts or Ph.D. degree whose undergraduate or graduate studies emphasized architecture, history of art, or related subjects.

Courses, seminars, and independent study under individual direction are combined to assure familiarity with the monuments, literature, methods, and problems of architectural history. Special features of the program include the opportunity to study and become familiar with the problems of teaching in a professional school context, and participation in research projects: e.g., the Cornell-Harvard Archaeological Exploration of Sardis, Turkey.

ARCHITECTURAL STRUCTURES. This program, leading to the degree of Master of Science, affords an opportunity for graduates of architectural schools to expand their creative design potential by increasing their knowledge and understanding of structural technology. It also is intended to appeal to graduates of related technical disciplines, for example civil engineering, providing a framework for exploring structural technology as it applies specifically to architecture. For the latter candidates, exposure to architectural disciplines would be included in the program of study.

Applicants for admission to the Architectural Structures program must include with their application a detailed description of their purpose in undertaking work in this area, outlining their background and aspirations. College level work in mathematics (calculus) is a requirement for admission, but this may be satisfied during the first semester of residence.

For information on the Master of Architecture degree (Urban Design) offered by the College of Architecture, see the section on Advanced Professional Degrees and consult the *Announcement of the College of Architecture.*

In addition to the scholarships and fellowships available through the Graduate School, the College of Architecture appoints a limited number of graduate assistants. Detailed descriptions of the requirements and curriculum in History and Structures may be found in the *Announcement of the College of Architecture.* Both programs are flexible and can be arranged to meet the needs of individual students and to build on prior preparation and experience.

Art (Arch.)

Faculty: A. C. Atwell, V. Colby, N. D. Daly, K. Evett, J. A. Hartell, H. P. Kahn, J. O. Mahoney, R. Richenburg, J. L. Squier.

Field Representative: J. O. Mahoney, 109 Franklin Hall.

APPROVED MINOR SUBJECTS

Painting 4 (M.F.A.: 2, 3) Sculpture 4 (M.F.A.: 2, 3)

Graduate work in the practice of painting or sculpture leading to the degree of Master of Fine Arts is offered by the Department of Art in the College of Architecture. Please consult the *Announcement of the College of Architecture.*

Students who hold Bachelors' degrees and have demonstrated special aptitude in the field of art may be admitted as candidates for the degree of Master of Fine Arts, majoring in either painting, sculpture, or graphic arts.

The course of study leading to this degree requires four terms of residence and is intended for those who wish to complete their education as artists. A high proportion of those who receive the degree enter the field of teaching at the college level.

The curriculum leading to the Master's degree is flexible enough to accommodate the needs of the individual student. The normal requirement for each of the first three terms is fifteen credit hours; of this from seven to ten credit hours will be assigned to studio work, two credit hours to a course in the theory and criticism of art, and the remainder to courses in other fields or additional studio work.

Graduate students in art are eligible for introductory or advanced courses in any field of study offered at the University; courses in writing, stagecraft, cinema, and music are available, as well as those in the usual academic subjects of the history of art, philosophy, anthropology, and the like. Courses in education are offered through the School of Education. In general, candidates for the Master's degree must complete fifteen credit hours of courses in the history, theory, or criticism of the arts taken either as graduate or undergraduate students.

Students majoring in painting may do studio work in sculpture and

vice versa, and majors in either field may elect a considerable amount of work in the graphic arts.

At the end of the third term of residence, the candidate is required to present a one-man exhibition of work done while in residence. The principal effort of the fourth term is a thesis consisting of creative work and, in addition, an essay dealing with a subject in the theory or history of the visual arts. A verbal examination occurs on presentation of the thesis.

Since the course is intended for those who in the opinion of the faculty are competent to do independent work in the field of their choice, all applicants must submit photographs of their work. Color slides are preferable for paintings.

It is not practical to admit candidates to the program at the beginning of the spring term as all available studio facilities, scholarships, and assistantships will have been allocated at the beginning of the school year.

History of Art and Archaeology (Arts)

Faculty: W. I. Homer, S. J. O'Connor, N. A. Pattillo, A. S. Roe, J. H. Turnure, F. O. Waage, M. W. Young.

Field Representative: A. S. Roe, 27 Goldwin Smith Hall.

APPROVED MAJOR AND MINOR SUBJECTS

American Art 1, 2, 3, 4
Ancient Art and
Archaeology 1, 2, 3, 4
Medieval Art 2, 3, 4
Modern Art 1, 2, 3, 4
Oriental Art 1, 2, 3, 4
Renaissance and Baroque Art 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in French, German, or Italian to be demonstrated upon admission to candidacy.

Graduate work in the history of the visual arts (architecture, painting, sculpture, and the minor arts) and in archaeology is offered through a combination of course and independent study and research under individual direction. A candidate for the Master's degree in archaeology may substitute relevant courses in such subjects as cultural anthropology for some of those in art history, and the candidate in classical archaeology may substitute courses in Latin and Greek.

Chinese Literature (Arts)

(See Asian Studies.)

City and Regional Planning (Arch.)

Faculty: G. H. Beyer, A. G. Feldt, J. C. Fisher, M. Hugo-Brunt, B. G. Jones, B. Kelly, T. W. Mackesey, K. C. Parsons, J. W. Reps, S. W. Stein.

Field Representative: K. C. Parsons, 106 W. Sibley Hall.

APPROVED MAJOR AND MINOR SUBJECTS

City Planning 1, 3, 4 Regional Planning 1, 3, 4

All applicants resident in the United States during the year preceding matriculation at Cornell must submit the scores of the Graduate Record Examination Aptitude Tests with their other credentials.

Major study for candidates for the degree of Ph.D. is limited to those who hold the degree of Master of Regional Planning or its equivalent.

A detailed description of the requirements and curriculum for the professional Master's degree, Master of Regional Planning, will be found in the *Announcement of the College of Architecture.*

For admission to candidacy for the Ph.D. degree with a major in City Planning or Regional Planning, a Master's degree in City or Regional Planning with course work equivalent to that required in the program at Cornell is ordinarily required. Candidates who lack the equivalent of this training or who hold the Master's degree in a related field and have had acceptable experience in city or regional planning practice or research may be required to take additional course work at the Master's level.

Candidates for the Ph.D. degree proposing to major in this Field must select a major subject from the two listed above. It is the policy of the Field to encourage selection of both minor subjects from related subjects outside the Field. Prospective students should therefore consult the descriptions in this Announcement of other subjects such as administrative engineering, aerial photographic studies, agricultural economics, architectural history, comparative government, econometrics and economics statistics, economic development, economic theory, housing and design, law, natural resources conservation, operations research, the political process, political theory, public administration, research methodology, sociology, statistics, sanitary engineering, and transportation engineering.

Since work for the Ph.D. is considered preparatory to making creative contributions to the Field, substantial competence and knowledge of basic analytical and research methods will be required. Candidates may fulfill this requirement by preparation previous to entrance or by course work at Cornell which may be in a minor subject. Candidates for the Ph.D. degree are expected to present a thesis of either a theoretical or applied nature.

Requirements for a minor subject in the Field while less rigorous than a major presume a suitable preparation for advanced work.

The Department of City and Regional Planning conducts a program of research in urban studies in cooperation with the Center for Housing and Environmental Studies.

In addition to the fellowships available through the Graduate School, the College of Architecture appoints a number of Master's and doctoral candidates to part-time teaching and research positions. Prospective students interested in applying for assistantships should write to the Dean of the College of Architecture.

The Classics (Arts)

Faculty: H. Caplan, P. H. DeLacy, G. H. Fairbanks, J. Hutton, D. Kagan, G. M. Kirkwood, P. Pucci, F. O. Waage.

Field Representative: P. Pucci, 125 Goldwin Smith Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Ancient History (see page 61)
Ancient Thought 3, 4
Classic Rhetoric in Original or Translation 3, 4
Classical Archaeology 2, 3, 4
Classics 4
Greek 1, 2, 3, 4
Indo-European Linguistics 3, 4
Latin 1, 2, 3, 4
Medieval and Renaissance Latin Literature 1, 2, 3, 4

While not a requirement, it is recommended that candidates submit Graduate Record Examination Aptitude Test scores when applying for admission.

Language requirement for Master's degree: proficiency in French or German to be demonstrated at least one term before the degree is awarded.

Admission to graduate study in a subject included in the Field of the Classics, except in archaeology, assumes a knowledge equivalent in general to that expected of a student who has pursued the subject concerned throughout four years of undergraduate study in a college of recognized standing.

Graduate work in the Classics is conducted in the main by the seminar system, the object of which is training in the methods, the principles, and the performance of independent research and criticism, and the work is therefore as far as possible put into the hands of the students themselves. A study room in the Olin Library building is reserved for the exclusive use of graduate students in the Classics.

For fellowships in Greek and Latin, see page 23. The income of the Charles Edwin Bennett Fund for Research in the Classical Languages is used each year in the way best suited to promote the object for which the fund was established.

Doctoral dissertations of an appropriate nature will be accepted for publication in the *Cornell Studies in Classical Philology*.

Comparative Literature (Arts)

Faculty: P. M. de Man, H. Dieckmann, R. Durling, G. Hartman, B. Pike (Comparative Literature); H. Shadick (Chinese); H. Caplan, G. Kirkwood, P. Pucci (Classics); M. Abrams, R. M. Adams, E. Fogel, R. E. Kaske, E. Rosenberg (English); J.-J. Demorest, D. I. Grossvogel, E. P. Morris (French); E. A. Blackall, O. J. M. Jolles (German); I. Rabinowitz (Hebrew); J. Freccero (Italian); D. Brenes, K. L. Selig (Spanish); G. Gibian (Russian).

Field Representative: Geoffrey Hartman, 169 Goldwin Smith Hall

APPROVED MAJOR SUBJECT

Comparative Literature 1

No Master of Arts degree is offered in Comparative Literature. Candidates are admitted directly to Ph.D. candidacy but are frequently advised to take a Master's degree in the literature which interests them most and constitutes their major field. The candidate's two minor subjects must involve two national literatures other that that chosen as the major; English and American Literature cannot be counted as two separate literatures. Standards of historical coverage and of critical discrimination in the major are equal to those expected from a Ph.D. candidate in that field. In the two minors, historical coverage is limited to a period (for example Middle Ages, Renais-

sance, Romantic) or to a genre (drama, novel, poetry, literary criticism, and critical theory). At the time of application, the candidate must be prepared for advanced study in three literatures taught in the original language.

English Language and Literature (Arts)

Faculty: M. H. Abrams, B. B. Adams, J. P. Bishop, J. F. Blackall, A. J. Caputi, M. J. Colacurcio, J M. Cowan, G. F. Cronkhite, R. M. Durling, D. D. Eddy, R. H. Elias, S. B. Elledge, F. G. Fike, J. A. Finch, E. G. Fogel, K. C. Frederick, R. A. Greenberg, G. H. Hartman, B. L. Hathaway, G. H. Healey, J. S. Herz, C. F. Hockett, R. E. Kaske, D. W. Kleine, J. W. Marchand, C. L. Marks, J. R. McConkey, H. S. McMillin, D. M. Mermin, F. W. Mineka, A. M. Mizener, D. Novarr, S. M. Parrish, F. C. Robinson, E. Rosenberg, W. M. Sale, W. D. Shaw, M. Shinagel, W. J. Slatoff, T. W. Stoehr, S. C. Strout.

Field Representative: E. G. Fogel, 235 Goldwin Smith Hall.

APPROVED MAJOR AND MINOR SUBJECTS

American Literature 3, 4
Creative Writing 2, 3, 4
Dramatic Literature 3, 4
English Linguistics 3, 4
English Literature 1, 2, 3, 4
The English Renaissance to 1660 3, 4
The Nineteenth Century 3, 4
Old and Middle English 3, 4
Poetry 3, 4
Prose Fiction 3, 4
The Restoration and Eighteenth Century 3, 4
The Twentieth Century 3, 4

The Field requires applicants to submit scores of the Graduate Record Examination (Aptitude and Advanced Tests), though in special circumstances the requirement may be waived. For scores to be available by the time applications for fellowships and scholarships are reviewed, the examination must be taken *by mid-January*.

Language requirement for Master's degree: proficiency in French, German, Greek, Italian, or Latin. Candidates failing to demonstrate proficiency during the first semester of residence will be required to complete two residence units after passing the examination unless an exception is made by the Field.

Language requirement for the doctorate: proficiency in French and German. The first language must be passed before the Qualifying Examination may be scheduled; the second language before Examination A may be scheduled. Besides the required languages, Latin is particularly recommended for all students, and Italian for those working in the literature of the Renaissance. Before receiving the degree, candidates for the doctorate must have a knowledge of Old English — both the language and the literature.

Applicants who have had no prior graduate study may apply for direct admission to the doctoral program. A few with superior qualifications will be admitted directly; others will be admitted as candidates for the Master's degree. During the second term of their candidacy for the Master's degree, those with distinguished records will be admitted to candidacy for the doctorate.

The student should plan to meet as speedily as possible the requirements imposed by the Graduate School and the Field; but apart from satisfying these, he may exercise a wide choice in making up his program. He may work

The Sage Graduate Center, the graduate residence hall and the center for many graduate activities.

in areas in which his preparation is weak, or he may concentrate in areas with which he is already familiar. Apart from Master's candidates who major in Creative Writing, the major for both Master's and doctoral candidates is English Literature (understood to include important American works). The candidate for the Master's degree is not expected to specialize. The candidate for the doctorate indicates his field of special study by designating a subject (e.g., The Nineteenth Century) as his "first minor." He also chooses a "second minor;" this may be English, or it may be in another literature, Classics, history, philosophy, linguistics, or speech and drama.

During their first year in residence, all students will complete eight one-term courses, at least four of them numbered 500 or above in the *Announcement of the College of Arts and Sciences.* For Master's candidates, one of the eight courses will be Introduction to Graduate Study and another a thesis course, with the Chairman of the Special Committee in charge; the Master's thesis of a candidate majoring in Creative Writing will consist of original fiction or poetry. Master's candidates who have announced their intention of proceeding to the doctorate will take Old English. All doctoral candidates will take the course in Research Methods and Materials and will complete two seminars; otherwise the Field imposes no specific course requirements beyond the first year of study. Doctoral candidates who have received their Master's degrees elsewhere than at Cornell will be excused from the courses in Old English and Research Methods and Materials only if they satisfy the Field Representative that they have already completed equivalent work.

Candidates for the Master's degree who expect to complete their work entirely in summer sessions will take two courses in each of their first four summers and then in the fifth summer register for the thesis course.

Candidates in English may apply for fellowships open to students in all Fields (see page 20); the George Lincoln Burr Fellowship, open to doctoral candidates in various Fields who wish to concentrate in medieval and Renaissance studies (page 23); and the Martin Sampson or the Class of 1916 Fellowships, awarded only to students in English (page 23). Every year, furthermore, the Department appoints to teaching assistantships a number of doctoral candidates who are completing, or have already completed, a year of graduate study. Candidates interested in assistantships must first apply to the Graduate School; thereafter, they need only write a brief letter of application to the Chairman, Department of English, Goldwin Smith Hall. Inquiries *about graduate work* should be directed to the Field Representative, same address.

German (Arts)

Faculty: V. T. Bjarnar, E. A. Blackall, J. B. Dallett, H. Deinert, P. de Man, O. J. M. Jolles, H. L. Kufner, J. W. Marchand, B. E. Pike.

Field Representative: O. J. M. Jolles, 182 Goldwin Smith Hall.

APPROVED MAJOR AND MINOR SUBJECTS

German Literature 1, 2, 3, 4
Germanic Linguistics 1, 2, 3, 4
Old Norse 3, 4

Language requirement for the Master's degree: proficiency in German, French, or Russian as soon as possible and no later than the beginning of the second semester of residence.

In the advanced courses in this Field the work is twofold: literary and linguistic. The history of German literature from the earliest period to the present day is treated in lecture courses with collateral reading. Special topics are selected for detailed study in the seminar on Germanic Linguistics and the seminar in German Literature. The courses offered in Germanic Linguistics include the study of Gothic, Old Saxon, and Old and Middle High German; they also afford an introduction to the methods of descriptive, historical, and comparative linguistics as applied to Germanic languages, dialectology, and the history of the German language from earliest times. The course on bibliography and method aims to impart the principles and methods of investigation and a knowledge of the bibliographical resources. Candidates for the minor subject in Old Norse will be allowed to concentrate either on the linguistic or the literary aspects of the subject, but candidates emphasizing the literary aspect will be required to study Old Norse literature in the original language. The Fiske collection of Icelandic materials in the Olin Library is one of the most important in the world and provides excellent opportunities for graduate work in Old Norse studies.

Candidates for the Ph.D. with a major in German Literature must select Germanic Linguistics as one of their minors; candidates for the Ph.D. with a major in Germanic Linguistics must select German Literature as one of their minors. Candidates for the Ph.D. in German are expected to have an adequate knowledge of French and Latin, and must pass the Graduate Reading Examination in French as one of the languages offered.

For further details of graduate work in German, see the *Guide for Graduate Students in German at Cornell University*, available from the Chairman of the Department of German Literature.

History (Arts)

Faculty: K. Biggerstaff, D. B. Davis, E. W. Fox, P. W. Gates, R. Graham, H. Guerlac, J. J. John, D. Kagan, W. F. LaFeber, F. G. Marcham, C. P. Nettels, W. M. Pintner, B. Tierney, L. P. Williams, O. W. Wolters.

Field Representative: W. F. LaFeber, 327 W. Sibley Hall.

APPROVED MAJOR AND MINOR SUBJECTS

American History 1, 2, 3, 4
Ancient History 1, 2, 3, 4
Early Modern European History 1, 2, 3, 4
English History 1, 2, 3, 4
History of Science 1, 2, 3, 4
Latin American History 1, 2, 3, 4
Medieval History 1, 2, 3, 4
Modern Chinese History 1, 2, 3, 4
Modern European History 1, 2, 3, 4
Russian History 1, 2, 3, 4
Southeast Asian History 1, 2, 3, 4

All applicants for admission to graduate study in the Field of History must include the scores of the Graduate Record Examination Aptitude Test with their other credentials.

The language requirement for the Master's degree: proficiency in French, German, or Russian. Candidates in American or Latin American History may meet the requirement with proficiency in Spanish. Another foreign language may be substituted if, in the judgment of the candidate's Special Committee, the relative amount, quality, and pertinence of source materials and scholarly writing in the candidate's approved major subject are superior in that lan-

guage to the one for which it is substituted. All candidates are expected to fulfill the language requirement upon entrance.

In the case of candidates for whom the M.A. will be the terminal degree and who do not need the language for research, the Department of History will entertain petitions for waiving the language requirement.

Candidates for the Ph.D. must demonstrate proficiency in two of the following languages: French, German, Russian; candidates for the same degree in American or Latin American History may choose Spanish for French. Candidates for the Ph.D. in Chinese History must choose Chinese, and those in Southeast Asian History a Southeast Asian language as one of the two languages. Candidates for the Ph.D. in Russian History must have a reading knowledge of Russian. Candidates for the Ph.D. in Ancient History must read both Greek and Latin in addition to French and German, and in Medieval History candidates must read Latin in addition to two of the approved languages.

All candidates are expected to demonstrate proficiency in at least one language upon entrance. All language requirements must be completed before a candidate may take the A Examination.

Candidates majoring in the Field of History may take minors in other history subjects or in other Fields of the Graduate School.

For available fellowships, see pages 18–23. Prospective students interested in applying for assistantships, of which a number are available to students who have already completed at least one year of graduate study, should write directly to the Chairman, Department of History, West Sibley Hall.

Housing and Design (H.E.)

(See page 81.)

Music (Arts)

Faculty: W. W. Austin, W. A. Campbell, D. J. Grout, W. C. Holmes, J. Hsu, K. Husa, J. Kirkpatrick, R. M. Palmer, H. E. Samuel, T. A. Sokol.

Field Representative: W. C. Holmes, Lincoln Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Musical Composition 1 (for A.Mus.D.), 2, 3, 4
Musicology 1, 2, 3, 4
Theory of Music 2, 3, 4

Applicants for admission are required to submit scores for the Graduate Record Examination Aptitude Test.

Language requirement for Master's degree: for majors in Musicology, proficiency in French and German; for majors in composition or theory, proficiency in French or German. Proficiency must be met immediately upon admission to candidacy.

Applicants for admission must take a test of musical proficiency, including sight singing, melodic and harmonic dictation, score reading, and sight reading at the piano. Sample copies of this test and further information may be obtained from the Music Department office.

Normally, students whose major is Theory of Music or Musical Composition

(including candidates for the A.Mus.D. degree) choose Musicology as a minor subject, and vice versa. Doctoral candidates choose a second minor subject in a related Field. It is especially important for doctoral candidates to equip themselves with a good reading knowledge of both French and German as early as possible.

A large microfilm collection of Renaissance music and music theory is available to qualified candidates working in this Field.

Candidates are expected to take active interest in musical performance. Choral and orchestral organizations of the University and the community welcome graduate students and their wives or husbands as members.

Philosophy (Arts)

Faculty: M. Black, S. M. Brown, Jr., J. V. Canfield, K. S. Donnellan, B. C. Goldberg, D. Lyons, N. Malcolm, N. C. Pike, D. Sachs, S. S. Shoemaker, R. R. K. Sorabji.

Field Representative: N. C. Pike, 327 Goldwin Smith Hall.

The Susan Linn Sage School of Philosophy, which comprises the Field of Philosophy in the Graduate School, was founded through the generosity of the late Henry W. Sage, who endowed the Susan Linn Sage Professorship and gave in addition $200,000 to provide permanently for instruction and research in philosophy.

The Philosophical Review, which is managed by the Sage School, is an international quarterly that publishes articles, reviews, and discussions in all branches of philosophy.

APPROVED MAJOR AND MINOR SUBJECTS

Aesthetics 1, 2, 3, 4
Epistemology 1, 2, 3, 4
Ethics 1, 2, 3, 4
History of Philosophy 1, 2, 3, 4
Logic 1, 2, 3, 4
Metaphysics 1, 2, 3, 4
Philosophy 4
Philosophy of Religion 1, 2, 3, 4
Philosophy of Science 1, 2, 3, 4
Political Philosophy 3, 4

Language requirement for Master's degree: proficiency in French or German immediately upon admission to candidacy.

The instruction offered to graduate students presupposes such undergraduate courses in the subject as would be taken by a student in the College of Arts and Sciences of Cornell University who had elected philosophy as a major subject. Those who have not had equivalent preparation are expected to make up their deficiences outside the work required for an advanced degree.

The Sage School provides opportunity for advanced study to two classes of graduate students: those whose major interest is in some branch of philosophy; and those whose chief branch of research is in allied fields but who desire to supplement this with a minor in philosophy.

1. Students whose major interest is in philosophy are required (a) to gain a general knowledge of the whole subject including its history, and (b) to select some aspect or subdivision of it for intensive study and research.

2. Students having a major interest in literature or the arts, in history or social studies, or in mathematics or a branch of experimental science are permitted to choose a minor in philosophy with such emphasis as best suits their

needs. For such students the School endeavors to outline a plan of philosophical study (in courses or directed reading) which will form a natural supplement to their field of research.

The aim of the Field in graduate work is to devote its resources primarily to the instruction of students who expect to proceed to the Ph.D. with a major in philosophy. It is not the normal policy of the Field to accept as graduate students those who have no intention of pursuing academic work beyond the M.A. degree. However, the Field will be prepared to accept as M.A. candidates those students who expect to continue advanced studies later, either in philosophy or in some other field, and those who, while not expecting to pursue graduate work beyond the M.A., nevertheless give satisfactory evidence of a serious interest in philosophy.

Romance Studies (Arts)

Faculty: F. B. Agard, C. Bandera-Gomez, J. Bernstein, D. Brenes, A. M. Colby, P. de Man, J.-J. Demorest, H. Dieckmann, R. M. Durling, C. L. Eastlack, J. Freccero, D. I. Grossvogel, R. A. Hall, Jr., C. S. Leonard, Jr., E. P. Morris, J. Parrish, B. L. Rideout, M. D. Saltarelli, K. Selig, A. Seznec, D. Solá, P. Wexler.

Field Representative: (Mrs.) Jean Parrish, 293 Goldwin Smith Hall.

APPROVED MAJOR AND MINOR SUBJECTS

French Linguistics 1, 2, 3, 4
French Literature 1, 2, 3, 4
Italian Linguistics 1, 2, 3, 4
Italian Literature 1, 2, 3, 4
Romance Linguistics 1, 2, 3, 4
Spanish Linguistics 1, 2, 3, 4
Spanish Literature 1, 2, 3, 4

The Field requires applicants to submit scores of the Graduate Record Examination (both Aptitude and Advanced Tests). For scores to be available by the time applications for fellowships and scholarships are reviewed, the examination must be taken *no later than December*.

In the Field of Romance Studies the student may concentrate either in linguistics or in literature.

ROMANCE LINGUISTICS. In Romance linguistics, the student is given training in four types of study and research: (1) general principles of linguistic analysis; (2) the description of the structure of the Romance language of his major interest; (3) the history, external and internal, of that language; and (4) the genetic and typological relationships of the Romance family of languages. Special emphasis is laid on the relation between linguistic history and cultural factors (literary, political, and social). A concomitant aim of this area is to afford instruction and practice in the application of linguistics to the teaching of one or more Romance languages.

Candidates in Romance linguistics may choose as their major subject either the linguistics (descriptive and historical) of a specific Romance language, or the comparative study of the Romance languages. Such candidates will normally have, as one of their minor subjects, the literature of the language in which their major interest lies. A prior knowledge of Latin is desirable; a candidate without prior knowledge of Latin will be expected to acquire a working acquaintance with its linguistic structure and history. Each candi-

date's program will be determined in individual consultation with his committee.

ROMANCE LITERATURE (French Literature, Italian Literature, and Spanish Literature). Graduate studies in Romance literature are designed to train students as scholars and as teachers of language and literature. The Field expects its candidates to acquire a certain fund of knowledge and certain skills. Under the heading of knowledge may well be included: direct knowledge of literary texts; literary history; intellectual history; philology; social and political history; biography; and linguistic theory. The most important skills are the critical understanding of texts, the explication of texts, annotating and editing of texts, and identifying and developing critical and scholarly problems.

Students will be expected to teach at least one full year either in the Division of Modern Languages or in the Department of Romance Studies. Their teaching will be closely supervised and will form an integral part of the doctoral program. Ordinarily, students will not teach during their first year of residence.

Applicants who have had no prior graduate study may apply for direct admission to the doctoral program. Those with superior records and qualifications may be admitted directly; others may be admitted for the Master's program if their intent is clearly to go on to the doctorate. Later admission to the doctoral program can be assured by a distinguished record at the Master's level. Those who wish to acquire the Master's degree for teaching at the secondary school level will be encouraged to apply to Cornell's Master of Arts for Teachers program rather than to the Field's Master of Arts program.

There are relatively few requirements imposed by the Graduate School or by the Field. As a Master's candidate, the student will usually spend his time broadening his interests; as a Ph.D. candidate he will spend more time studying a given area in depth. It is hoped that the choice of the first minor will be either a second Romance literature (French, Spanish, or Italian) or the history of the major language.

Graduate students are expected to meet certain standards at specified points in their training:

1) Incoming students will take a written examination, and will be given an interview, in their major language. Most entering students will find it advisable to do at least a year's course-work in that language.

2) Students must comply with the Graduate School requirements in French or German (see pages 14–15). Most students will take one examination or the other on entrance.

Candidates for the Master's degree are expected to take five one-semester courses in their major and three in their minor. They will also take one course in the history of the language of their major. By the end of their third term of residence, students will be expected to demonstrate proficiency in the major language and in Latin. This requirement may be satisfied by examination or by a stylistics course and a course in Latin. All first-year students will attend the pro-seminar in literary studies (credit two hours per semester).

A Master's thesis or essay will be written in the language of the major, except in cases where the major language is also the native language.

Candidates for the Ph.D are expected to take eight one-semester courses in their major and three in each of two minors. These courses will be chosen in consultation with the candidate's special committee. They will also take two courses in the history of the major language. They must meet the major-language and Latin requirements by the end of their fourth term of residence.

All language requirements must be met before the candidate presents himself for the A examination.

Further particulars will be found in the *Procedural Guide for Graduate Students in Romance Literature* (furnished upon request).

Slavic Studies (Arts)

Faculty: P. Carden, G. H. Fairbanks, G. Gibian, R. L. Leed.

Field Representative: G. Gibian, 193 Goldwin Smith Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Russian Literature 1, 2, 3, 4

Slavic Linguistics 1, 2, 3, 4

Course offerings in Slavic Linguistics include Old Bulgarian and Old Russian; they also include courses in descriptive, historical, and comparative methods of analysis applied to the Slavic languages. Candidates for advanced degrees with a major in Slavic Linguistics should have a reading knowledge of both French and German; candidates for the Ph.D. with a major in Slavic Linguistics are expected to develop proficiency in a second Slavic language.

Course offerings in Russian Literature include graduate seminars and courses in various genres of pre-1917 and post-1917 Russian literature. A variety of upperclass undergraduate courses are also open to graduate students. Emphasis is placed on critical interpretation of literary texts and the relationship of literature to Russian history and thought.

The graduate program aims at training scholars and teachers in the subjects of Russian literature and culture. Master of Arts and doctoral candidates with a major in Russian Literature are encouraged to choose minor subjects in government, Russian history, Slavic linguistics, or in a western European literature. They enjoy great flexibility in the working out of individual programs to fit their needs and undergraduate preparation. A detailed description of typical graduate programs and requirements can be obtained from the Department of Russian Literature, 191 Goldwin Smith Hall.

Speech and Drama (Arts)

Faculty: H. D. Albright, G. E. Beck, H. Caplan, M. A. Carlson, R. A. Clark, R. Murphy, J. F. Wilson.

Field Representative: M. A. Carlson, 216 Lincoln Hall.

APPROVED MAJOR AND MINOR SUBJECTS

DIVISION OF DRAMATIC PRODUCTION:
Drama and Theatre 1
Dramatic Production 2, 3, 4

DIVISION OF RHETORIC AND PUBLIC ADDRESS:
Experimental Study of Oral Discourse 3, 4
Principles of Public Address 3, 4
Rhetoric and Public Address 1, 2, 3, 4

Applicants for graduate study in the Field of Speech and Drama must take the Graduate Record Examination Aptitude Test in sufficient time to permit

consideration of the results along with the application for admission to the Graduate School.

Students majoring in the Division of Dramatic Production may substitute Spanish or Italian for French, and Chinese or Japanese for French, German, or Russian; those majoring in the Division of Rhetoric and Public Address may substitute Latin or Greek for either French, German, or Russian.

The chief aim of graduate work in the Field of Speech and Drama is to develop competent investigators and teachers. In many cases, the work will require more than the minimum periods of residence. Ordinarily, residence in this University during at least two academic years will be necessary for the doctorate.

Candidates for the Master's degree in the Division of Dramatic Production are required to complete at least one academic year and one summer session in residence.

Candidates for the Doctor's degree in the Division of Rhetoric and Public Address will usually choose one minor subject in a Field concerned with literary history and criticism or with the social sciences.

In the Division of Dramatic Production, candidates for the Doctor's degree will be required to take dramatic literature in the Field of English Language and Literature as a minor subject, unless they have already pursued systematic study of this subject. If preparing for general teaching, candidates will be advised to take additional courses in rhetoric and public address. Candidates for the doctorate in this Division must expect to be in residence two years and one summer beyond the requirements for the Master's degree.

Students in the Division of Dramatic Production will be expected to avail themselves of the opportunities for theatre practice afforded by various branches of the Cornell University Theatre.

A fuller description of the graduate programs in speech and drama may be obtained by writing to the Field Representative, Department of Speech and Drama.

SOCIAL SCIENCES

Agricultural Economics (Ag.)

Faculty: D. J. Allee, R. D. Aplin, R. Barker, S. Barraclough, C. A. Bratton, E. H. Brown, M. E. Brunk, D. L. Call, K. S. Carpenter, H. E. Conklin, L. C. Cunningham, L. B. Darrah, B. A. Dominick, Jr., W. G. Earle, D. K. Freebairn, D. C. Goodrich, Jr., G. W. Hedlund, R. B. How, C. D. Kearl, C. W. Loomis, E. A. Lutz, N. G. M. Luykx II, J. W. Mellor, J. E. Metz, Jr., T. T. Poleman, Jr., K. L. Robinson, D. G. Sisler, R. S. Smith, B. F. Stanton, R. P. Story, W. G. Tomek, S. W. Warren.

Field Representative: G. W. Hedlund, 102 Warren Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Agricultural Economics 4
Agricultural Policy and Economic Development 1, 2, 3, 4
Farm Management 1, 2, 3, 4
Marketing and Business Management 1, 2, 3, 4
Prices and Statistics 1, 2, 3, 4
Public Administration and Finance 1, 2, 3, 4

Applicants are urged to take the Graduate Record Examination Aptitude Test and to submit the results with their application.

Every candidate for the Ph.D. must demonstrate proficiency in two foreign languages. In meeting this requirement only one language may be chosen from each of the following four groups: (1) Russian, (2) French, Italian, Spanish, (3) Dutch, German, Swedish, and (4) Chinese, Hindi, and Japanese.

A major or minor in agricultural policy and economic development offers opportunities for specialized study in agricultural geography, agricultural land economics, agricultural policy, and international economic development. Marketing and business management offers opportunities in agricultural marketing, business management, and food distribution. A major or minor in farm management offers opportunities for concentration in either farm finance or farm management.

Students majoring in this Field are encouraged to take courses in related Fields such as Economics, Mathematics, and Statistics. Candidates for the Ph.D. degree are expected to select at least one minor in another Field. Courses in related Fields are listed in the Announcements of other colleges and schools including the College of Arts and Sciences, the College of Engineering, the Graduate School of Business and Public Administration, and the School of Industrial and Labor Relations.

Assistantships are available that provide an opportunity for part-time employment in teaching, research, or extension. Assistants normally conduct their thesis research as part of their assistantship duties in connection with departmentally financed projects.

A broad knowledge of the physical and biological aspects of agriculture is valuable background for graduate work in the Field of Agricultural Economics, but an undergraduate major in Agricultural Economics is not required.

Anthropology (Arts)

Faculty: R. Ascher, C. F. Hockett, A. R. Holmberg, K. A. R. Kennedy, B. Lambert, W. W. Lambert, A. H. Leighton, M. E. Opler, J. M. Roberts, L. Sharp, R. J. Smith, V. W. Turner, A. P. Wolf, F. W. Young.

Field Representative: Morris E. Opler, 227 McGraw Hall

APPROVED MAJOR AND MINOR SUBJECTS

Anthropology 1, 2
Applied Anthropolgy 4
Archeology 2, 3, 4
Physical Anthropology 3, 4
Social Anthropology 3, 4

All applicants resident in the United States during the year preceding matriculation at Cornell must submit the scores of the Graduate Record Examination Aptitude Test with their other credentials. Those who are accepted, but who do not reside in the United States at the time of application, must submit scores by the close of their first year at Cornell.

Language requirement for the Master's degree: college entrance language or proficiency in one language acceptable to the Special Committee.

The language requirement for the Ph.D. candidate is proficiency in two foreign languages, no more than one of which may be chosen from any one of the following four groups: (1) Russian, (2) Dutch, German, (3) French, Italian, Portuguese, Spanish, and (4) Burmese, Chinese, Hindi, Indonesian,

Japanese, and Thai. The candidate may petition for the approval of languages other than those listed.

The graduate program for the Ph.D. in anthropology is devoted to the development of creative scholars prepared for independent research and responsible teaching in anthropology. To this end each Ph.D. candidate is expected to command a knowledge of (1) the fundamentals of the subfields of anthropology (i.e., social anthropology or ethnology, archeology, linguistics, and physical anthropology) and their interrelation, (2) anthropological theory, (3) methods and techniques of research relevant to anthropology, (4) the anthropology of one major culture area of the world, and (5) the general characteristics of the other major culture areas of the world.

The Ph.D. candidate, in consultation with the Chairman of his Special Committee, selects two minors which, in combination with the major, form a unitary program of study. He may not, however, select applied anthropology as a minor subject. For the student whose major is outside the Field of Anthropology, minors in archeology, physical anthropology, and applied anthropology are approved for the Ph.D. only.

Although the Field strongly recommends that candidates seeking a career in anthropology elect the Ph.D. program, M.A. majors are occasionally accepted. The candidate for the M.A. degree in anthropology is expected to command a knowledge of (1) the fundamentals of social anthropology (ethnology) and of two of the other three subfields of anthropology, (2) anthropological theory, and (3) the anthropology of one major culture area of the world. He selects one minor, with the approval of his Committee Chairman, from any field in the Graduate School, with the exception that social anthropology is not available. The candidate for the M.A. degree in archeology is expected to command a specialized knowledge of (1) the archeology of either the eastern or the western hemisphere, (2) archeological theory and interpretation, (3) the basic concepts of social anthropology, and (4) field and laboratory techniques. He selects one minor, with the approval of his Committee Chairman, from any Field in the Graduate School.

Students majoring in anthropology or electing a minor under the Field of Anthropology have the opportunity to participate in research conducted by the staff. For additional information on staff research, details of the majors and minors administered by the Field of Anthropology, and for the brochure, *Graduate Work in Anthropology,* write to the Graduate Field Representative.

Asian Studies (Ag., Arch., Arts)

Faculty: L. P. Adams, D. E. Ashford, A. C. Atwell, K. Biggerstaff, N. C. Bodman, J. Bordie, H. R. Capener, J. M. Echols, G. H. Fairbanks, J. Gair, F. H. Golay, D. G. E. Hall, R. B. Jones, Jr., G. McT. Kahin, G. B. Kelley, K. A. R. Kennedy, J. W. Lewis, T. C. Liu, N. G. M. Luykx II, J. W. Mellor, H. C. Mills, S. J. O'Connor, M. E. Opler, R. A. Polson, H. Shadick, L. Sharp, R. J. Smith, A. P. Wolf, J. U. Wolff, O. W. Wolters, M. W. Young.

Field Representative: H. Shadick, 102 Franklin Hall

APPROVED MAJOR AND MINOR SUBJECTS

Asian Studies 3, 4
Chinese Linguistics 3, 4
Chinese Literature 1, 2, 4
South Asian Linguistics 4
Southeast Asian Linguistics 4

Language requirements for the Master's degree: proficiency in French, German, Japanese, or Russian by the beginning of the second semester of residence.

Graduate work in Chinese literature assumes at least two years of Chinese language study prior to admission. Requirements for the doctor's degree with a major in Chinese literature are: (1) familiarity with representative works in classical and vernacular Chinese and with critical studies in Chinese; (2) broad knowledge of the available translations of Chinese literature and critical studies in other languages; (3) specialized knowledge of at least two subfields such as the Confucian or Taoist classics, poetry, drama, fiction, classical prose, or twentieth-century writings.

The requirements for the M.A. degree or for a minor in Chinese literature are roughly equivalent to (1) or (2) above.

The Ph.D candidate specializing in Asia (or with a serious interest in the area) may select a minor in the Field of Asian Studies consisting of either: (a) concentrated interdisciplinary study of one area of Asia, or (b) disciplinary or topical concentration which cuts across area boundaries. Details of the minor are to be worked out in consultation with the member of the candidate's Special Committee representing Asian Studies. Because specialization in Asia usually involves the study of an Asian language, it is essential that the candidate discuss the problem of language work with the entire membership of his Committee, particularly with the member representing his major field.

There are at Cornell three programs concerned with teaching and research on Asia—the China Program, South Asia Program, and Southeast Asia Program. (Selection of a minor in Asian Studies does not in all cases qualify the candidate for membership in one of these programs.) Requirements for membership in these programs will be found under their individual listings.

Major and minor work is also offered in Oriental art (see History of Art) and in modern Chinese history and Southeast Asian history (see History).

Several fellowships and research assistantships are available for which application should be made directly to the Director of the China Program, the Director of the Southeast Asia Program, or the Director of the South Asia Program. These are described more fully on pages 35–43 of this Announcement.

The work of the Department of Asian Studies is recognized and supported by the United States Office of Education. Under the National Defense Education Act, Cornell has three Language and Area Centers: East Asia, South Asia, and Southeast Asia. Languages currently offered are Burmese, Cebuano, Chinese (Mandarin and Hokkien), Dutch, Hindi, Indonesian, Japanese, Javanese, Malay, Pali, Sanskrit, Sinhalese, Thai, Urdu, and Vietnamese. Graduate students in Asian Studies are eligible for the National Defense Foreign Language Fellowships offered by the U.S. Office of Education. Application forms should be requested directly from the Graduate School and returned to it for forwarding to the U.S. Office of Education if approved.

Graduate students in Asian Studies are also eligible for the Foreign Area Training Fellowships administered by the Social Science Research Council for study in the United States and for research overseas. Fulbright teaching and research awards for Taiwan, Hong Kong, India, Japan, Malaya, Pakistan, Philippines, Singapore, and Thailand are available to qualified graduate students who are citizens of the United States.

For additional details, consult the *Announcement of the Department of Asian Studies,* which may be obtained by writing the Announcements Office, Day Hall.

Business and Public Administration (BPA)

Faculty: A. A. Altshuler, D. E. Ashford, R. E. Baker, F. T. Bent, H. Bierman, E. Brooks, W. D. Carmichael, M. G. de Chazeau, A. T. Dotson, A. R. Drebin, T. R. Dyckman, E. S. Flash, F. F. Gilmore, A. M. Hillhouse, G. D. Hughes, J. G. B. Hutchins, T. M. Lodahl, A. K. McAdams, A. E. Nilsson, R. V. Presthus, J. M. Rathmell, S. Smidt, J. Summerskill, D. A. Thomas, P. P. Van Riper, R. R. West, R. F. White, L. K. Young.

Field Representative: J. G. B. Hutchins, 518 Malott Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Business Administration 1, 3, 4
Development and Public Administration 3, 4
Finance and Accounting 3, 4
Hospital Administration 3, 4
Managerial Economics 1, 3, 4
Marketing 3, 4
Organizational Behavior and Theory 1, 3, 4
Production 3
Public Administration 1, 3, 4

The language requirement for the Ph.D. degree is proficiency in two foreign languages, no more than one of which may be chosen from any one of the following four groups: (1) Russian, (2) French, Italian, Spanish, (3) German, Swedish, and (4) Arabic, Chinese, Hindi, Japanese.

The Ph.D. program in the Field of Business and Public Administration is designed to provide advanced education within this broad area for those seeking careers in teaching and research. A student majoring in the Field is expected to become reasonably grounded in the literature and practices of professional management and in the primary features of the institutional setting appropriate to his interest, e.g., business or government. He will also be expected to acquire competence in the use of quantitative methods, including accounting, statistical analysis, and in some instances mathematical formulations. Finally, he is expected to acquire competence in the research methodology appropriate to his subjects.

A candidate majoring in this Field must select a major subject from either business administration, managerial economics, organizational behavior and theory, or public administration. He may also select two minors from the remaining subjects. A student is, however, often strongly encouraged to select one minor from an appropriate disciplinary or applied outside Field listed in this Announcement. Among those from which students frequently select are City and Regional Planning, Economics, Government, Industrial and Labor Relations, Industrial Engineering and Operations Research, and Sociology. Attention is called to the remarkably wide range of choices of this nature available at Cornell. It is, however, necessary for a student to have or to acquire the preparation essential for graduate work in such Fields.

Ph.D. candidates in other Fields desiring to take minors in this Field may choose any of the nine subjects listed except production. However, to secure acceptance they must present convincing evidence of adequate preparation

for graduate work. Candidates for the Masters' degrees are not ordinarily permitted to take minors.

The M.A. and M.S. degrees are not awarded in this Field. A student interested in a Master's degree should examine the program of the Graduate School of Business and Public Administration leading to the professional Masters' degrees of M.B.A. and M.P.A. (See the *Announcement of the Graduate School of Business and Public Administration.*)

BUSINESS ADMINISTRATION. This subject embraces comprehensively the relationship of business enterprises to its economic, political, and social environment, and the art of administering such organizations, both in the primary functional areas of marketing, finance, production, personnel, and control, and more importantly in the making and execution of policy. A candidate is expected to demonstrate substantial knowledge of the pertinent patterns, problems, and literature of the subject as a whole.

MANAGERIAL ECONOMICS. This subject involves economic analysis of the economy generally, of industries, and of the firm, primarily from the point of view of the management decision maker. The program is designed to provide a thorough grasp of economic theory and of quantitative methods as they may be used in the framework of economic institutions to formulate policy. The candidate will devote special study to one or more of a wide range of areas, such as, managerial decision making, international economic relations, economic development, investment project analysis, money and banking, transportation, and business and government relations. He may emphasize either a qualitative or a quantitative approach, but a basic understanding of both is required.

Applicants are required to submit the scores of either the Graduate Record Examination or the Admission Test for Graduate Study in Business.

ORGANIZATIONAL THEORY AND BEHAVIOR. Work in this subject focuses on social- and behavioral-science approaches to the study of human activity in organizational settings. The major concern is with regularities, differences, and relationships in human behavior directed toward purposive ends. Systematic observation, theoretical analyses, and empirical investigation are stressed. A fundamental grounding in at least one of the social sciences is expected of majors. Majors without grounding in the literature and practices of general administration in an institutional setting must take one minor in such an area.

PUBLIC ADMINISTRATION. A broad interdisciplinary approach to public administration will be required. Not only the study of governmental policies, policy formulation, power relationships, administrative behavior, basic management functions such as personnel and finance, and the broad environment of public affairs, but also competence in bureaucratic and organizational theory and in the methods of the social sciences will be expected.

Admission to the Ph.D. program is dependent on suitable preparation for the subjects to be selected, through academic work in either professional, business or public administration, or in the supporting disciplines, or both. Because of the scope of the field, no one pattern of preparation can be specified. It is however expected that an applicant will have strong foundations in several of the pertinent fields of knowledge.

Child Development and Family Relationships (H.E.)

Faculty: H. Bayer, W. L. Brittain, U. Bronfenbrenner, R. H. Dalton, E. C. Devereux, Jr., J. Doris, H. Feldman, M. E. Ford, J. Harding, L. Hodgden, H. Levin, M. Parkman, H. Ricciuti, G. Suci.

Field Representative: G. Suci, Martha Van Rensselaer Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Child Development 3, 4 Family Relationships 3, 4
Child Development and Family Relationships 1, 2, 3, 4

Applicants resident in the United States during the year before entering Graduate School are required to submit their scores on the Graduate Record Examination Aptitude Test when applying for admission.

There is no foreign language requirement for the Master's degree, but Ph.D. candidates must demonstrate reading ability in two languages besides English, chosen from French, German, and Russian.

The graduate program is concerned primarily with the preparation of students for careers in research and college teaching dealing with the scientific study of children and families. All students are expected to acquire a basic background in the behavioral sciences, and to master a broad base of knowledge and human development and of the family as a social system. Individual programs can be planned so as to provide for major concentration in the study of child development, the family, or child and family psychopathology.

A substantial number of research projects conducted by faculty members in the Field provide varied research experiences for graduate students either as research assistants or through participation in research practica which are an integral part of the academic program. Staff research projects include children's dreams, children's language, cross-cultural studies of family structure and pesonality development, husband-wife relationships, infant behavior and development, and investigations of cognitive development.

Masters' degree programs ordinarily require one and one-half to two years for completion; Ph.D. programs about four years. Students with relatively little preparation in the behavioral sciences should plan on additional time to complete degree requirements. Admission to graduate study is based primarily on evidence of the student's competence to do advanced work in a research-and-theory-oriented program, and on broad preparation as a basis for specialization. Both the Master's and Ph.D. degrees require the completion of a research thesis. All degree candidates must develop some competence in statistical methods, usually by taking one or more appropriate courses.

Approximately 22 teaching and research assistantships are ordinarily available, along with nine National Institute of Mental Health Traineeships.

For further details concerning graduate work in the Field, write to the Department of Child Development and Family Relationships for the brochure *Graduate Training in the Scientific Study of Children and Families.* Since the subject matter in Child Development and Family Relationships draws on several major disciplines, students are encouraged to supplement their work in the Field with studies in related Fields. For courses in these related disciplines, see the *Announcements of the Colleges of Agriculture, Arts and Sciences, and*

Home Economics, and of the Schools of Education and Industrial and Labor Relations.

City and Regional Planning (Arch.)

(See pages 55–56.)

Economics (Arts)

Faculty: G. P. Adams, Jr., M. G. Clark, T. E. Davis, M. G. de Chazeau, D. F. Dowd, W. D. Evans, L. M. Falkson, J. C. H. Fei, F. H. Golay, G. H. Hildebrand, J. G. B. Hutchins, A. E. Kahn, R. W. Kilpatrick, T. C. Liu, C. Morse, P. M. O'Leary, R. T. Selden, G. J. Staller, B. P. Stigum, J. Vanek.

Field Representative: Chandler Morse, 357 Goldwin Smith Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Econometrics and Economic Statistics 1, 2, 3, 4
Economic Development and Planning 1, 2, 3, 4
Economic History 1, 2, 3, 4
Economic Theory and Its History 1, 2, 3, 4
Industrial Organization and Control 1, 2, 3, 4
International Economics 1, 2, 3, 4
Labor Economics 1, 2, 3, 4
Monetary and Financial Economics 1 2, 3, 4
Public Finance and Fiscal Policy 1, 2, 3, 4

All candidates resident in the United States during the year preceding matriculation at Cornell must take the Graduate Record Examination Aptitude Test.

Language requirement for the Master's degree: proficiency in an approved foreign language must be established before taking the final examination.

The language requirement for the Ph.D. degree is proficiency in two foreign languages, no more than one of which may be chosen from any one of the following four groups: (1) Russian, (2) French, Italian, Spanish, (3) Dutch, German, Swedish, and (4) Arabic, Chinese, Hindi, Japanese.

Students majoring in this Field should consult the descriptions in this Announcement of the Fields of Agricultural Economics, Business and Public Administration, and Industrial and Labor Relations for other subjects related to the work in economics.

In addition to their major and two minors, doctoral candidates will be required to demonstrate competence in economic theory, its history, and its methodology, the latter including economic statistics, social accounting, and except when the major adviser explicitly approves an exemption, mathematical economics. A student who elects as a major or minor any of these required subjects must broaden his program by taking work in "outside subjects" approved by his Special Committee.

All candidates for advanced degrees who elect a minor in economics will be held for work in economic theory and its history.

Candidates for the Ph.D. degree with a major in Economics are encouraged to elect one minor subject in another Field.

Applications for fellowships and scholarships in Economics should be filed with the Dean of the Graduate School prior to the deadline date (see Calendar). Applications for teaching assistantships, however, should be made directly to the Chairman of the Department of Economics.

Education (Ed.)

Faculty: H. G. Andrus, J. P. Bail, F. C. Baldwin, S. E. Blackwell, M. H. Bruce, Jr., R. L. Bruce, R. N. Campbell, V. E. Christensen, H. R. Cushman, S. W. Davis, R. E. Doherty, W. E. Drake, A. E. Durfee, J. R. Egner, R. H. Ennis, J. Failing, R. B. Fischer, F. F. Foltman, H. A Geiselmann, M. D. Glock, D. B. Gowin, F. B. Heltzel, C. W. Hill, L. B. Hixon, M. Johnson, Jr., P. G. Johnson, J. P. Leagans, H. Levin, S. Levy, W. I. Lowe, D. J. McCarty, G. W. McConkie, J. Millman, A. G. Nelson, H. Y. Nelson, H. I. Patterson, W. Pauk, I. Peard, K. Rhodes, R. E. Ripple, V. N. Rockcastle, F. H. Stutz, F. K. T. Tom, G. F. Vars, H. L. Wardeberg.

Field Representative: C. W. Hill, 100 Stone Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Agricultural Education, 1, 2, 3, 4
Curriculum and Instruction, 1, 2, 3, 4,
Development of Human Resources 1, 2, 3, 4
Education 4
Educational Administration and Supervision 1, 2, 3 4
Educational Psychology and Measurement 1, 2, 3, 4
Extension and Adult Education 1, 2, 3, 4
Guidance and Personnel Administration 1, 2, 3, 4
History, Philosophy, and Sociology of Education 1, 2, 3, 4
Home Economics Education 1, 2 3, 4
Nature, Science, and Conservation Education 1, 2, 3, 4

Students majoring in the Field of Education may be admitted to candidacy for either of two types of advanced degree. Requirements for the *general degrees* of M.A., M.S., Ph.D., administred by the Graduate School, are stated in this Announcement. Requirements for the professional degrees administered by the Division of Education of the Graduate School, are described in the *Announcement of the School of Education*, accompanied by a listing and description of courses. (See also pages 146–148 of this Announcement.)

All applicants to candidacy for advanced degrees with majors in Education who reside in the United States or Canada and whose native language is English are required to have scores submitted from the Miller Analogies Test, or the Graduate Record Examination (the Aptitude Test), or both, before admission to candidacy. This applies to both the general and professional degrees.

In the Field of Education there is no foreign language requirement for the Masters' degrees unless stipulated by the candidate's Special Committee.

The following information differentiates briefly among the several major subjects for both general and professional degrees:

AGRICULTURAL EDUCATION. Candidates for any advanced degree are expected to have extensive undergraduate preparation in agriculture. Teaching experience is desirable for all candidates and required for candidacy at the doctoral level.

Advanced-degree programs are designed to prepare for positions such as teaching on the secondary and post-high school levels, administration of vocational and technical education programs, adult education, international agricultural education, educational work with governmental and nongovernmental agencies and organizations, and teacher education and supervision. All programs provide opportunity to observe and participate in teaching, research, in-service training, and other aspects of agricultural education.

CURRICULUM AND INSTRUCTION. Doctoral programs and those leading to the M.A. or M.S. degrees are designed to prepare candidates to engage in research and scholarly activity on problems of curriculum and instruction, to serve as teacher educators at the college or university level, or to hold such positions of leadership in public or private school systems as curriculum coordinator, department head, academic subject supervisor, and director of elementary or secondary education. Master's level programs are offered for students with a liberal arts undergraduate background who wish to become certified to teach in elementary schools or in the secondary school subjects of English, social studies, mathematics, and foreign languages.

DEVELOPMENT OF HUMAN RESOURCES. (See Industrial and Labor Relations, page 82.)

EDUCATIONAL ADMINISTRATION AND SUPERVISION. For a major in this subject the candidate must (1) demonstrate proficiency in the following areas of knowledge: (a) theoretical concepts of administration and supervision, (b) understanding of the basic disciplines undergirding the relationships between individuals and groups within an organization and between organizations, (c) identification and conduct of research in educational administration, (d) environmental factors which influence the educational enterprise; and (2) have had a field experience in the functional areas of educational administration, e.g., school finance, school law, school personnel, and the like.

EDUCATIONAL PSYCHOLOGY AND MEASUREMENT. Students wishing to prepare for professional careers in teaching educational psychology in institutions of higher learning, school psychology, mental testing, or educational research may apply for admission with a major in this subject. Students may specialize in statistics or in any of the traditional aspects of psychology as they apply to human behavior. Previous preparation in professional education or in psychology is not prerequisite. Any deficiencies must be satisfied during candidacy for the particular degree.

EXTENSION AND ADULT EDUCATION. Advanced study in this subject is designed to develop administrators, supervisors, and specialists for positions in adult, extension, and community development programs both in the United States and in countries abroad. In addition to meeting academic and other standards of the Graduate School, the applicant must have: (1) successful professional experience in adult or extension education, or community development programs, or closely related work; (2) professional leadership ability as evidenced by positions held, promotions, and recommendations of superior officers; and (3) sound personal and professional reasons for undertaking graduate study in this Field. When offered as a minor, at least item

three above must be met. Ph.D. candidates must select one minor outside the Field of Education.

GUIDANCE AND PERSONNEL ADMINISTRATION. A major in this subject area is appropriate for students who wish to prepare for positions in counseling, personnel administration in higher education, and counselor education. A candidate who intends to become a public school counselor must include in his program the courses specified for certification in the state where he expects to work. A doctoral candidate is required to complete one minor in some branch of psychology, and a second minor chosen in consultation with the chairman of his Special Committee.

HISTORY, PHILOSOPHY, AND SOCIOLOGY OF EDUCATION. All doctoral students will be expected to have or develop an acquaintance with the following four branches of this subject and to choose one for an area of specialization: history of education, philosophy of education, educational sociology, and comparative education. A candidate who chooses comparative education will also be expected to become a specialist in one of the other three branches.

Ordinarily about half of a candidate's program will include study in one or more of the following disciplines: history, philosophy, sociology, government, and economics. One minor for the doctorate must be outside the Field of Education.

Areas of faculty and student study and research interests include structure of subject matter, analysis of educational concepts, fundamental assumptions in educational research critical thinking, relation of philosophy and education, curriculum, logic in teaching, nature of theory in education, role of philosophy in teacher education, school-community relations, and social roles of teachers.

HOME ECONOMICS EDUCATION. Candidates are expected to have an undergraduate major in home economics. Courses in education and experience in teaching are recommended for everyone except those in professional degree programs.

Students prepare for positions in adult education, extension teaching, secondary school teaching, college teaching, administration and supervision of home economics programs, and research in home economics education. Students may observe and participate in a variety of home economics programs.

Candidates are expected to acquire a general knowledge of (1) the history and philosophies of education; (2) principles of curriculum development, educational psychology, teaching methods, evaluation, and research methods in education.

Departmental research projects provide opportunities for both Master's and doctoral candidates to gain experience in research procedures and may yield data for their theses.

Interested persons should contact Professor Sara Blackwell, Head, Department of Home Economics Education, Martha Van Rensselaer Hall.

NATURE, SCIENCE, AND CONSERVATION EDUCATION. Teachers and other persons with an interest in science, natural history, nature study, and the conservation of natural resources will find that programs of study can be arranged to meet requirements for a Master's degree or the doctorate in either of two areas of professional preparation:

A. Preparation for science teaching, science supervision, science curriculum development, and teacher preparation and supervision at elementary, second-

ary, and college levels. Programs may meet requirements for a permanent certificate, or they may be designed so that the preparation is dedicated mostly to broadening general preparation in the sciences. It is also possible to design programs that deepen and up-date preparation in the special area where the person will serve. The several science departments of the University offer a wide variety of courses related to the subject matter preparation while the School of Education offers many helpful professional courses.

B. Nature study and conservation education. Programs are available for individuals with a special interest in the scientific study of nature leading to positions in college teaching, in public or private conservation departments, or other agencies dedicated to the development of public understanding and enjoyment of natural resources. In addition to serving in public or private organizations, there are opportunities for free-lance work as writers, illustrators, and lecturers. In addition to the major subject, supporting courses are found in the Department of Conservation and in other departments of the University. Often included are those in natural history literature, natural history writing, journalism, drawing, scientific illustrating, speech, and fine arts.

Geography (Arts)

(See page 132.)

Government (Arts)

Faculty: A. Altshuler, W. F. Berns, A. D. Bloom, H. W. Briggs, A. T. Dotson, M. Einaudi, A. Hacker, G. McT. Kahin, R. Lerner, J. W. Lewis, S. Muller, C. Rossiter, M. Rush, A. Sindler.

Director of Graduate Studies and Field Representative: A. T. Dotson, 305 West Sibley Hall

APPROVED MAJOR AND MINOR SUBJECTS

In regard to minor subjects, see the first paragraph of the description below.
Group I
American Government 1, 2, 3, 4
Group II
Political Theory 1, 2, 3, 4
Group III
Comparative Government 1, 2, 3, 4
Group IV
International Law and Relations 1, 2, 3, 4

In contemporary political science, many of the traditional classifications are changing. The Field of Government, therefore, does not limit minors to a specified number of subjects. For example, within the major subject, American government, a candidate for a higher degree may choose to minor in American constitutional law, the American political process, or some other substantial aspect of this subject. Within political theory, a candidate may wish to minor in modern, or ancient and medieval theory. Within comparative government, a candidate may wish to minor in Western or non-Western political systems. Within international law and relations, a candidate may

wish to minor in international law only, or the relations of groups of nations whose goals or systems of government make them a reasonable focus for graduate study. Graduate students, both within and without the Field, are encouraged to select, with the approval of their Special Committee, minor subjects which are adapted to their scholarly goals and also represent significant portions of the Field.

A course of studies leading to a higher degree in the Field of Government seeks to ensure for each candidate a broad knowledge of the Field, as well as a specialized competence which will enable him to pursue with distinction a professional or scholarly career in political science.

The Field of Government offers four groups of subjects for graduate study. A candidate for the Ph.D. degree must offer one major and at least two minor subjects. No more than one minor may be chosen from a single group of subjects; one of the minors may be outside the Field of Government. A candidate for the Master's degree must offer one major and at least one minor; the minor or minors must belong to a different group from the major, or may be outside the Field of Government.

All candidates are expected to secure a broad preparation in the Field. The Special Committee and the Director of Graduate Studies may, at the time of the Field Review or the Qualifying Examination, recommend particular courses or seminars outside the major or minor subjects which must be completed satisfactorily. The Committee and the Director will, in place of such courses or seminars, administer an examination to assess the candidate's preparation.

FIELD REVIEW. Within two weeks after the beginning of residence, the Director of Graduate Studies, with the assistance of an *ad hoc* committee from the faculty of the Field or from other fields where indicated, will conduct an initial review of the candidate's preparation and tentative plan of study.

QUALIFYING EXAMINATION. Each candidate will take a Qualifying Examination during the last month of his second term of graduate study. The examination will focus on the course and seminar work done during the year. The Special Committee will decide whether to have a written as well as an oral examination.

Each candidate will be placed in one of three categories on the basis of his performance on the Qualifying Examination. A candidate placed in category (a) will be confirmed in Ph.D. candidacy. Upon satisfactory completion of his Final Examination (Part A), he may petition the Graduate School to award him a Master's Degree. A student placed in category (b) will be awarded a Master's Degree upon satisfactory completion of the requirements for that degree. A student placed in category (c) will not be permitted to re-register as a student in the Field of Government.

FINAL EXAMINATION (PART A). Each candidate will present his major and minor subjects for a Final Examination (Part A) at a time to be fixed by his Special Committee in accordance with the regulations of the Graduate School. The Part A examination must be passed before the candidate begins full-time work on a thesis or dissertation, and before the completion of six terms of residence, unless the Field sets an earlier or later date because of special circumstances. The examination will be written and oral.

FINAL EXAMINATION (PART B). Each candidate will be examined orally on his thesis or dissertation.

A candidate for the Ph.D. may, with the consent of his Committee, substitute one of the following languages for French, German, or Russian: Burmese, Chinese, Hindi, Indonesian, Thai, and Vietnamese. At the discretion of his Special Committee, a candidate for the M.A. degree may be required to demonstrate reading ability in one foreign language.

All applicants for admission to graduate study in the Field of Government must submit the scores of the Graduate Record Examination Aptitude and Advanced Tests with their other credentials; applicants for financial assistance must take these tests at least two weeks before February 1.

Home Economics, General (H.E.)

Faculty: See Child Development and Family Relationships, Education, Food and Nutrition, Household Economics and Management, Housing and Design, Institution Management, Textiles and Clothing.

Field Representative: correspondence should be directed to the Field Representative of the major subject.

APPROVED MINOR SUBJECT

General Home Economics 5

For students who wish to minor to give breadth of contact with the Field of Home Economics rather than depth in one area. Courses to be selected from the offerings in several of the areas of home economics. Approved as a minor subject for the Master's degree only.

Hotel Administration (Hotel)

Faculty: R. A. Beck, P. R. Broten, C. E. Cladel, M. H. Ericson, G. W. Lattin, H. J. Recknagel, E. S. Reynolds, C. I. Sayles, T. W. Silk, L. L. Smith, J. J. Wanderstock.

Field Representative: G. W. Lattin, 103 Statler Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Hotel Administration 1, 2, 4 Hotel Accounting 2, 3, 4 *

Graduate work in the Field of Hotel Administration is open to those who have completed in full the requirements for the undergraduate degree in the School of Hotel Administration and to them only.

Students holding Bachelors' degrees in the liberal arts or in general business administration who wish a program in hotel administration normally enroll in the undergraduate division. They may become candidates for an additional Bachelor's degree or at their choice simply enroll for a specialized program of hotel administration courses suited to their particular needs.

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* Hotel Accounting may not be taken as a minor subject for the degree of Ph.D. if the major subject is Hotel Administration.

Household Economics and Management (Ag., Arts, H.E., I.L.R.)

Faculty: G. J. Bymers, A. J. Davey, M. E. Purchase, M. A. Rollins, R. S. Steidl, E. Vatter, K. E. Walker.

Field Representative: K. E. Walker, 122 Martha Van Rensselaer Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Household Economics 2, 3, 4 Household Management 2, 3, 4
Household Economics and Managament 1, 2, 4

Admission to graduate work is based primarily on evidence of the student's competence to do advanced work. A general or specialized major in home economics is acceptable as background for study in this Field. Students with majors other than home economics for their baccalaureate degrees will also be considered since other subject matter areas are applied to the work and finances of the home. All candidates resident in the United States during the year preceding matriculation at Cornell must submit the scores of the Miller Analogies Test or the Aptitude Test of the Graduate Record Examination with their other credentials.

The Field offers opportunities for study and research with staff members having specialized interests in consumption economics, marketing, family financial management, family economics, design and layout of work areas, household equipment, chemical and physical processes applied to household work, work simplification, and home management.

Programs of graduate work are individually planned to fit the needs of the student and his objectives. No prescribed course of study is required of all graduate students. No two programs would be exactly alike because the student's past experiences, education, and future goals are considered.

Students selecting a major in household economics and management are expected to take courses in both phases of the Field; for the degree of Ph.D., the minor subjects are usually selected to support one phase or the other. Since the subject matter in household economics and management draws on several disciplines, appropriate minor subjects may be chosen from a variety of fields including the Fields of Agricultural Economics, Anthropology, Economics, Education, Industrial and Labor Relations, Psychology, and Sociology, as well as other branches of home economics. Candidates for the Ph.D. degree may substitute Danish, Norwegian, or Swedish for German.

Housing and Design (Arch., H.E.)

Faculty: G. H. Beyer, L. L. Bower, H. J. Cady, M. Langford, G. C. Millican, S. Neblett, A. L. Welling.

Field Representative: M. Langford, 3M13 Martha Van Rensselaer Hall.

APPROVED MAJOR AND MINOR SUBJECT

Housing and Design 1, 2, 4

Language requirement for the Master's degree: college entrance language, or proficiency in a language approved by the Special Committee.

For the degree of M.A. with a major in housing and design, the work should be focused either in housing or in design. The student should have a general knowledge of basic concepts of the particular area (or branch of the area) in the Field of Housing and Design in which he proposes to major.

The program for the degree of M.A. varies for each phase of study. Flexibility in programing allows for varying backgrounds and objectives of students. A major must obtain comprehensive knowledge of one of the emphases within the Field. The student is required to fill in gaps in his background where they apply in such areas as social science, fine arts, statistics, and research methods. Such a student may need to spend additional time at Cornell. The candidate should choose a minor in a related field.

A major in the Field of Housing and Design leading to the Ph.D. degree is offered. The emphasis is on the socio-economic and family aspects of housing.

For work toward the doctorate with a major in Housing and Design the student must expand his knowledge beyond the specialized subject in which he focused for work toward the Master's degree. Professional experience is desirable. Two minors are selected from fields related to housing and design.

Members of the staff will direct work in the following areas:

Design: Professors Cady, Millican, Neblett, Welling.

Socio-economic aspects of housing: Professors Beyer, Bower, Langford.

Industrial and Labor Relations (I.L.R.)

Faculty: L. P. Adams, R. L. Aronson, I. Blumen, P. E. Breer, G. W. Brooks, R. N. Campbell, J. T. Carpenter, N. H. Cheek, Jr., M. G. Clark, A. H. Cook, D. E. Cullen, R. E. Doherty, W. D. Evans, R. H. Ferguson, F. F. Foltman, W. H. Friedland, L. W. Gruenfeld, K. L. Hanslowe, G. H. Hildebrand, W. L. Hodges, V. H. Jensen, M. R. Konvitz, A. G. Korman, H. A. Landsberger, A. H. Leighton, D. M. MacIntyre, P. J. McCarthy, J. T. McKelvey, E. Mesics, F. B. Miller, J. G. Miller, D. G. Moore, J. O. Morris, M. F. Neufeld, R. L. Raimon, R. F. Risley, N. A. Rosen, J. Schulman, F. Slavick, A. W. Smith, N. A. Tolles, H. M. Trice, W. J. Wasmuth, W. F. Whyte, L. K. Williams, J. P. Windmuller.

Field Representative: F. B. Miller, 101 Ives Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Collective Bargaining, Labor Law, and Labor Movements 1, 2, 3, 4

Economic and Social Statistics 1, 2, 3, 4

Industrial and Labor Relations Problems 4

International and Comparative Labor Relations 3, 4

Labor Economics and Income Security 1, 2, 3, 4

Organizational Behavior 1, 2, 3, 4

Applicants must include in their credentials the results of the Graduate Record Examination (Aptitude Test). If, for satisfactory reasons, a person cannot take the examination before he wishes his application considered, the admissions committee may act provisionally pending submission of scores at a later date.

Language requirement for Master of Science degree: proficiency in one language approved by the Special Committee before beginning the second residence unit.

Candidates for the Ph.D. degree may substitute Spanish for French.

Applicants may be interviewed in Ithaca (and occasionally elsewhere) by members of the Graduate Committee of the Field and by other faculty members representing subjects in which the candidate proposes to study. Inquiries concerning interviews should be directed to the Graduate Field Representative, New York State School of Industrial and Labor Relations.

Applications for graduate assistantships to begin in September should be received not later than February 1; for February, not later than November 1. Write to the Graduate Field Representative for application material.

Note, also, the fellowships of the Field of Industrial and Labor Relations and the special tuition scholarships, page 00.

A description of the program leading to the degree of Master of Industrial and Labor Relations (M.I.L.R.), which is designed to provide broad coverage and some specialization, is found in the *Announcement of the School of Industrial and Labor Relations*. Briefly, the M.I.L.R. program is essentially a course program requiring three semesters exclusive of the Summer Session, with at least twelve courses, eight of which are required. There is no language or thesis requirement.

For both the M.S. and Ph.D. degrees, emphasis is placed upon independent study and research. The following are minimum requirements prerequisite to the independent investigations required in the major or minor subjects:

COLLECTIVE BARGAINING, LABOR LAW, AND LABOR MOVEMENTS. For a Ph.D. major, the candidate must show proficiency in the following areas of knowledge: (1) history of the labor movement and collective bargaining in the United States; (2) history of unionism and labor relations in major industries; (3) theories of trade unionism and collective bargaining; (4) structure, government, administration, and activities of the labor movement and of major national unions; (5) structures, procedures, practices, and major issues in collective bargaining; (6) federal and state legislation and leading cases in labor relations law; (7) role of government in labor relations, with emphasis on the methods and implications of different forms of dispute settlement; (8) history and problems of labor movements in labor relations in other countries; (9) bibliography and major sources of information in collective bargaining and trade unionism.

For a Ph.D. minor, (1), (3), (4), (5), (6), and (7) are required.

For an M.S. major, (1), (4), (5), (6), and (7) are required.

For an M.S. minor, (1), (4), and (5) are required.

ECONOMIC AND SOCIAL STATISTICS. For a major in this subject the candidate must show (1) thorough understanding of the principles of statistical reasoning, including such mathematical statistics as is necessary for their development; (2) proficiency in the use of statistical methods and in the processing of statistical data; (3) competence in applying the proper statistical tools of analysis to a specific topic in economics or social studies.

For a minor, the level is less advanced than for a major.

INDUSTRIAL AND LABOR RELATIONS PROBLEMS. (Available only as a minor to graduate students in fields of study other than Industrial and Labor Relations.)

A candidate for an advanced degree must have a general understanding of the subject matter in the Field of Industrial and Labor Relations. In order to prepare for a minor in this subject, the candidate will normally complete three to five courses in accordance with a program approved by his Special Committee.

INTERNATIONAL AND COMPARATIVE LABOR RELATIONS. (Available only as a minor subject.)

This subject is concerned with (1) the development and current role of labor movements in countries in various stages of industrialization with special reference to ideological, economic, political, and social factors influencing the history, policies, and activities of labor organizations; (2) the development of an industrial labor force in the context of social and cultural change; (3) similarities and diversities in systems of labor-management relations at different stages of economic development; (4) labor market, wage policy, and economic security problems, especially in countries undergoing rapid economic change; and (5) national and international organizations having special interests in international labor questions.

In addition to attaining, through comparative study and other methods, a basic knowledge of (1), (2), (3), (4), and (5), students electing a minor in international and comparative labor relations are expected to acquire a thorough knowledge of labor problems and labor-management relations in *one* specific country or area other than the United States.

LABOR ECONOMICS AND INCOME SECURITY. This subject involves analysis of the labor force, labor markets, wages and related terms of employment, income distribution, unemployment, health and safety in industry, superannuation, and private programs and legislation designed to meet income and employment problems.

For a major in this subject, the candidate must demonstrate (1) comprehensive knowledge of historical developments and current issues in the area of employment and income; (2) skill in analysis of economic, political, social, and administrative problems; (3) knowledge of the significant legislation dealing with income, employment, and employee welfare; (4) detailed acquaintance with the literature and sources of information available; (5) familiarity with income and employment problems and related legislation in selected foreign countries.

For a minor, (2) and (3) are required.

ORGANIZATIONAL BEHAVIOR. For a major in this subject, the candidate must demonstrate:

I. Knowledge of the fields basic in individual and social behavior and of concepts of administration.

II. Competence in one of the three areas of study, as follows:

A. Human relations. (1) Principal human relations problems found in industrial and labor relations, and the bearing of these problems on collective bargaining and labor and management organizations; (2) theories of human organization; (3) effect of organization structure, work-flow, and technology on individual and group relations; (4) problems involved in the relationship between industry and society.

B. Development of human resources. (1) Significant problems and issues related to the education and training of the work force. Historic trends in the philosophies, policies, and practices of public and private organizations concerned with the development of manual, technical, and managerial personnel; (2) current social, economic, political, and technological factors influencing the development of human resources; (3) organizational behavior and administrative

practices as they affect the growth and development of the individual; (4) theoretical and applied aspects of organizing and managing developmental programs in particular organizations; (5) principal concepts of learning and of educational methods related to the development of human resources.

C. Personnel Management. (1) The nature and scope of the personnel function and the social, economic, and political factors which influence its development; (2) the organization of the personnel function and the techniques, methods and procedures utilized in carrying on the personnel activities of an organization; (3) industrial and labor legislation and regulatory functions of government as related to the personnel function; (4) basic factors affecting the relationships between individuals and groups within an organization and among organizations as related to the personnel function.

III. Ability to isolate issues worthy of research, to identify and locate relevant studies or other sources of information, and independently to develop and conduct additional research.

For a minor, I and III and either II-A (1) and (4) or II-B (1), (2), and (5) or II-C (1) and (2) are required.

Institution Management (H.E.)

Faculty: M. Bloetjes, K. Cutlar, M. Knickrehm, K. Longrée.

Field Representative: M. Knickrehm, 170B Martha Van Rensselaer Hall.

APPROVED MAJOR AND MINOR SUBJECT

Administrative Dietetics 2, 4

A strong background of undergraduate courses in food and nutrition and the supporting physical and biological sciences, and a well-balanced program in other branches of home economics are expected. Undergraduate courses in institution management and some experience in administrative dietetics are desirable.

Graduate work leading to the Master's degree may emphasize either administrative or technical aspects of the Field. There is no prescribed program of study for either the major or the minor in this Field. It is expected that the program will supplement the student's previous training and experience to achieve a well-rounded knowledge of the subject, with due consideration given to the student's purpose in undertaking graduate study.

Related minors are in other branches of home economics, particularly food and nutrition, nutrition, or such subjects as personnel administration or education.

Members of the staff will direct research in institution administration and quantity foods.

The Department of Institution Management in the College of Home Economics offers opportunities for research in a well-equipped quantity food research laboratory and available operational food services. Several graduate assistantships are available.

International Agricultural Development (Ag., Arts, I.L.R.)

Faculty: D. E. Ashford, F. T. Bent, C. W. Boothroyd, P. A. Buck, M. G. Cline, H. E. Conklin, L. V. Crowder, T. E. Davis, B. L. Ellenbogen, H. L. Everett, R. Feuer, D. K. Freebairn, W. H. Friedland, F. H. Golay, D. B. Hand, R. F. Holland, W. K. Jordan, W. C. Kelly, G. C. Kent, R. P. Korf, F. V. Kosikowski, D. J. Lathwell, J. P. Leagans, J. K. Loosli, N. G. M. Luykx II, H. A. MacDonald, J. G. Matthysse, J. W. Mellor, P. A. Minges, R. B. Musgrave, T. T. Poleman, Jr., R. A. Polson, R. M. Smock, E. L. Stone, Jr., R. D. Sweet, G. W. Trimberger, K. L. Turk, A. G. van Veen, F. W. Young.

Field Representative: K. L. Turk, 102 Roberts Hall.

APPROVED MINOR SUBJECT

International Agricultural Development 4

This Field is intended primarily for students who are preparing for service in foreign countries. The student will seek depth of knowledge by majoring in a biological, physical, or social science. The minor subject draws from several disciplines with the objective of assisting the student in understanding the special conditions and problems of newly developing economies. While this minor is planned specifically for students majoring in one of the graduate Fields of agriculture, other qualified students are welcome. It is intended for students from other countries as well as for those from the United States. Students will register for seminars, courses, and special problems offered by the several departments and colleges.

A student minoring in this Field is encouraged to gain speaking proficiency in a language likely to prove most useful in this area of service in addition to meeting the language requirements in his major Field.

A student may not minor in this Field if he is minoring in Asian Studies or Latin American Studies, and he may not select a professor for this minor who also serves on the Graduate Faculty in the student's major Field.

Latin American Studies (Ag., Arts, I.L.R.)

Faculty: F. Agard, S. Barraclough, J. S. Bernstein, D. Brenes, T. Davis, M. Dominguez, C. L. Eastlack, B. L. Ellenbogen, D. Freebairn, R. K. Goldsen, R. Graham, A. R. Holmberg, H. A. Landsberger, J. Morris, D. F. Solá J. M. Stycos, W. F. Whyte, F. Young.

Field Representative: T. E. Davis, 205 Rand Hall.

APPROVED MINOR SUBJECT

Latin American Studies 4

The requirements for the minor in Latin American Studies include (1) a knowledge of Latin American history, culture, political organization, and problems of economic development, and (2) a reasonable command of spoken Spanish and comprehension of written Spanish. Candidates primarily inter-

ested in Brazil may satisfy this requirement by demonstrating their ability to speak and read Portuguese but must also be able to read Spanish.

Law (Law)

Faculty: R. A. Anthony, H. W. Briggs, W. D. Curtiss, W. T. Dean, W. R. Forrester, H. A. Freeman, K. L. Hanslowe, H. G. Henn, W. E. Hogan, M. R. Konvitz, J. W. MacDonald, I. R. Macneil, L. W. Morse, W. E. Oberer, R. S. Pasley, N. Penney, D. L. Ratner, E. F. Roberts, Jr., R. B. Schlesinger, G. Thoron, E. N. Warren.

Field Representative: R. S. Pasley, 258M Myron Taylor Hall.

APPROVED MINOR SUBJECT

Law 4 (for general degrees)

The Master of Laws (LL.M.) and the Doctor of the Science of Law (J.S.D.) degrees are conferred. The former is intended for the student who desires to increase his knowledge of law by work in a specialized field. The latter is intended for the student who desires to become a legal scholar and to pursue original investigations into the function, administration, history, and progress of law.

The minimum residence required is two full semesters, but completion of the LL.M program will usually require one summer in addition, and the J.S.D. program normally requires three to four semesters. Longer periods may be required by the nature of the candidate's program, which is arranged on an individual basis. A candidate for either degree will ordinarily be expected to concentrate on one legal field and to do a substantial amount of work in at least one other field.

The Special Committee of each candidate may require demonstration of a reading knowledge of one or more foreign languages if the Committee deems it to be desirable for the proper achievement of the program, but there is no fixed language requirement applicable generally to graduate work in law.

Linguistics (Arts)

Faculty: F. B. Agard, N. C. Bodman, J. W. Bordie, J. M. Cowan, C. L. Eastlack, J. M. Echols, G. H. Fairbanks, J. W. Gair, R. A. Hall, Jr., B. L. Hathaway, C. F. Hockett, R. B. Jones, Jr., R. E. Kaske, G. B. Kelley, H. L. Kufner, R. L. Leed, C. S. Leonard, Jr., J. W. Marchand, F. C. Robinson, M. D. Saltarelli, D. F. Solá, P. Wexsler, J. U. Wolff.

Field Representative: G. H. Fairbanks, 223 Morrill Hall.

APPROVED MAJOR AND MINOR SUBJECTS

General Linguistics, 1, 2, 4

Chinese Linguistics, see Asian Studies
English Linguistics, see English Language and Literature
French Linguistics, see Romance Studies
Germanic Linguistics, see German

Indo-European Linguistics, see The Classics
Italian Linguistics, see Romance Studies
Romance Linguistics, see Romance Studies
Slavic Linguistics, see Slavic Studies
South Asian Linguistics, see Asian Studies
Southeast Asian Linguistics, see Asian Studies
Spanish Linguistics, see Romance Studies

All applicants resident in the United States during the year before entering the Graduate School are required to submit their scores in the Graduate Record Examination Aptitude Test when they apply for admission.

The M.A. program with a major in general linguistics is broad and flexible, designed to provide for the training of students with highly diverse aims, from foreign language teaching (including the teaching of English as a second language) to machine processing of language data. For an M.A. candidate who intends to continue toward a Ph.D., a reading knowledge of one foreign language approved by the Graduate School is required.

The Ph.D. program in general linguistics is designed for the training of experts thoroughly at home in the whole range of pure and applied linguistics. Familiarity with mathematics and anthropology is highly desirable. In addition to the Graduate School's foreign language reading requirement, every Ph.D. candidate must demonstrate fluent oral control in one language other than his native language.

Special research interests of the staff members, in which formal or informal course work can be arranged upon demand, range widely, and the following list is intended merely as suggestive: American Indian languages; dialectology and linguistic geography, especially in the French, German, Italian, and Russian areas; language and culture; Pali and Old Persian; pidginized and creolized languages; information theory; mathematical and computational linguistics.

Inquiries for further information should be directed to the Graduate Field Representative for Linguistics, Division of Modern Languages, Morrill Hall.

Psychology (Arts)

(See page 111.)

Rural Sociology (Ag.)

Faculty: F. D. Alexander, H. R. Capener, R. L. Carroll, G. J. Cummings, B. L. Ellenbogen, J. Harp, O. F. Larson, J. W. Longest, R. A. Polson, W. W. Reeder, P. Taietz, R. M. Williams, Jr., F. W. Young.

Field Representative: John Harp, 234 Warren Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Methods in Social Research 3, 4
Organization Methods and Community Development 2, 3, 4
Rural Sociology 1, 2, 4

All American and Canadian applicants are requested to submit the scores of the Graduate Record Examination Aptitude Test with their other credentials.

The language requirement for the Ph.D. degree is proficiency in two foreign languages, no more than one of which may be chosen from any one of the following four: (1) German, (2) Russian, (3) French, Italian, Spanish, and (4) Arabic, Chinese, Hindi, Japanese, Urdu.

Graduate study in the Field of Rural Sociology prepares for college teaching and research; extension work in rural sociology; rural development work in the developing countries; research work with governments, private organizations, and agricultural businesses; and consultation in organization methods and community development. A recent Ford Foundation grant supports an expanded rural sociology program of training and research related to International Agricultural Development.

Members of the Field of Rural Sociology have a continuing research program within the framework of the Cornell University Agricultural Experiment Station in which graduate students may participate for purposes of research training. Among the currently active projects are community organization, demographic studies, longitudinal study of college students, research related to adjustments in human and physical resources, social change, the sociology of health, studies of technological change and modernization in developing countries, and voluntary associations. Emphasis is being given to developing comparative studies and to studies of the "modernization" process in both high- and low-income countries. Staff members participate in the Asian and Latin American area programs.

Members of the Field of Rural Sociology also have a continuing program within the Cooperative Extension Service of the New York State College of Agriculture. This provides graduate students an opportunity to gain experience through working with members of the staff who serve as extension specialists in rural sociology.

A student offering rural sociology as a major for the Ph.D. degree is expected to acquire a thorough knowledge of (a) methodology of sociological research, (b) organization methods and community development, (c) rural sociology and the research in this Field, and (d) sociological theory and its history.

When rural sociology is offered as a major for the M.S. degree or as a minor for the Ph.D. degree, the candidate is expected to acquire a general knowledge of sociological theory, (b), (c), and (d) listed above.

Rural Sociology cooperates with the Field of Sociology in offering opportunities for study of the comparative modernization of societies. In Rural Sociology such study is a generalized emphasis within the major.

When organization methods and community development is offered as a major for the M.S. degree or as a minor for the Ph.D. degree, the candidate is expected to acquire a thorough knowledge of organization methods and community development and a general knowledge of sociological theory, (a), and (c), listed above.

When methods in social research is offered as a minor for the Ph.D. degree, the candidate is expected to acquire a thorough knowledge of the methodology of research employed in his major Field.

Majors for the Ph.D. degree are required to take one minor outside the Field of Rural Sociology and in most cases will be encouraged to take both minors outside the Field.

In general, for an M.S. major in the Field of Rural Sociology, the minor should be selected outside the Field.

Minors in agricultural economics, anthropology, extension education, family relationships, general sociology, guidance and personnel administration, social

psychology, and statistics are among the most frequently chosen by majors in the Field of Rural Sociology.

The various college Announcements, which describe courses, should be consulted. Of interest to students who major or minor in the Field of Rural Sociology will be the offerings of the Departments of Anthropology, Psychology, and Sociology in the College of Arts and Sciences; of the Departments of Agricultural Economics and Rural Education in the College of Agriculture; of the Department of Child Development and Family Relationships in the College of Home Economics; of the School of Industrial and Labor Relations; of the Graduate School of Business and Public Administration; and of the College of Architecture. Students interested in the Far East will wish to consult the *Announcement of the Department of Asian Studies.*

The Department of Rural Sociology has graduate assistantships in teaching, research, and extension which provide part-time employment; included are teaching and research assistantships in support of the work in International Agricultural Development.

Sociology (Arts)

Faculty: C. Ackerman, L. Churchill, A. Feldt, R. K. Goldsen, D. P. Hayes, W. W. Lambert, A. H. Leighton, R. H. W. Longabaugh, R. McGinnis, L. Meltzer, G. C. Myers, G. F. Streib, J. M. Stycos, W. E. Thompson, W. F. Whyte, R. M. Williams, Jr.

Field Representative: R. K. Goldsen, McGraw Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Demography-Ecology 1, 3, 4
General Sociology 2, 4
Research Methodology 1, 3, 4
Social Organization and Change 1, 3, 4
Social Psychology 1, 3, 4

Graduate Record Examination scores are required for admissions consideration.

Language requirement for the Master's degree: proficiency in one language acceptable to the Special Committee as soon as possible and no later than the second semester in residence.

A two-semester sequence in Mathematics for Social Scientists (Math. 201–202) may be substituted for the language.

The language requirement for the Ph.D. degree is proficiency in two foreign languages, no more than one of which may be chosen from any one of the following four: (1) Russian, (2) Dutch, German, (3) French, Italian, Portuguese, Spanish, and (4) Chinese, Hindi, Indonesian, Japanese.

In addition to a general background in the social sciences, the entering student should have some knowledge of the basic concepts and applications of quantitative analysis.

Members of the Field sponsor various social research programs and field projects in which graduate students may participate for purposes of research training. Research activities of the staff have included studies in intergroup relations, values, demography, organizational behavior, social gerontology, small groups, and political sociology. Staff members also participate closely in teaching and research activities of the Asian and Latin American area programs. While teaching assistantships are normally granted only to students

already in residence, a number of research assistantships are awarded annually to incoming students. The International Population Program provides fellowships and research internships to selected students of demography. The Social Systems Program provides traineeships to selected students of methodology and social organizations. The Social Psychiatry Program provides teaching assistantships to selected students. Applications should be made directly to the Field Representative, Department of Sociology, McGraw Hall.

The Master's program or its equivalent is prerequisite to candidacy for the Ph.D. degree in any of the subjects of Sociology. M.A. candidates at Cornell major in General Sociology which covers the four specific subjects of Sociology: social organization and change, research methodology, demography-ecology, and social psychology. Students entering Cornell with a Master's degree from other institutions will be required to make up any deficiencies in the subjects mentioned.

Ph.D. candidates will select their major from one of the four subjects listed below with the general requirements of each. Two minors are required, at least one of which should be chosen from outside the Department of Sociology.

DEMOGRAPHY-ECOLOGY. When offered as a major: (1) a thorough knowledge of demographic and ecological theory and substantive research; (2) a thorough knowledge of the techniques of demographic and ecological data collection and analysis; (3) a working knowledge of the theory and methods of social organization and change.

When offered as a minor, a general knowledge of the topics specified in (1) and (2) above.

RESEARCH METHODOLOGY. When offered as a major: (1) a detailed knowledge of the logic of science, (2) a general knowledge of research design, data collection techniques, and analytic procedure, (3) a working knowledge of the theory of social organization and change, (4) a concentration of study in one of the areas listed in (1) and (2).

When offered as a minor, requirements (1), (2) and (3).

SOCIAL ORGANIZATION AND CHANGE. When offered as a major: (1) a thorough knowledge of theories of, and research in, social organization and social change; (2) a working knowledge of research methods; (3) a detailed knowledge of two subfields in social organization such as the following: formal organization and bureaucracy, the family, ethnic relations, political sociology, social stratification, public opinion, sociology of religion, sociology of work.

When offered as a minor: a general knowledge of parts (1) and (2) of the above requirement and a working knowledge of one subfield.

SOCIAL PSYCHOLOGY. When offered as a major: (1) a thorough knowledge of social psychological theory and research, with emphasis upon current developments; (2) a working knowledge of the methodology of social psychological research; (3) a working knowledge of psychology, sociology, and relevant aspects of other related disciplines; and (4) detailed knowledge of some specialized aspect of social psychology to be selected by the student.

When offered as a minor: a general knowledge of parts (1) and (2) of the above requirements, as well as a working knowledge of whichever aspects of social psychology are relevant to the Ph.D. dissertation topic.

The prospective student is advised to consult the following Announcements for information about instruction and research in sociology: (1) *Announcement of the College of Arts and Sciences*, Departments of Anthropology, Asian

Studies, Latin American Program, Psychology, and Sociology, (2) *Announcement of the College of Agriculture,* Department of Rural Sociology, (3) *Announcement of the College of Home Economics,* Department of Child Development and Family Relationships, (4) *Announcement of the School of Industrial and Labor Relations,* (5) *Announcement of the Graduate School of Business and Public Administration.* A comprehensive brochure, *Sociology at Cornell,* may be obtained by writing to the Field Representative.

Statistics (Ag., Arts, Engin., I.L.R.)

Faculty: R. Bechhofer, I. Blumen, K. Choi, R. Farrell, W. T. Federer, D. L. Iglehart, H. Kesten, J. Kiefer, P. J. McCarthy, D. S. Robson, S. R. Searle, F. L. Spitzer, B. Stigum, L. Weiss, J. Wolfowitz.

Field Representative: P. J. McCarthy, 356 Ives Hall.

APPROVED MAJOR SUBJECT

Statistics 1, 2

Language requirement for Master's degree: proficiency in French, German, or Russian, or an approved substitute before completion of the second residence unit.

The aim of graduate work in Statistics is the training of individuals who will (1) have a thorough knowledge of the theoretical basis of modern statistical method and have demonstrated ability to make significant contributions to this theory, (2) have developed an understanding of the methods of scientific research in general and the role which statistics plays in this research, and (3) have had experience in aiding workers in various fields in the application of statistical method. For this reason, the minor subject or subjects must be taken with individuals outside the Field, and one minor will ordinarily be in the Field of Mathematics. Students preparing for graduate work in statistics are urged to obtain a thorough grounding in mathematics through advanced calculus since their programs of study will be seriously delayed if this preparation is lacking. If their interest is primarily in mathematical statistics, they should consult the section on the Field of Mathematics in this Announcement.

A student majoring in statistics must complete a graduate sequence of courses in mathematical statistics (offered in the Department of Mathematics) which has been approved by his Committee. Other course work required of majors in statistics will be chosen from among offerings by the above listed members of the Field in the Department of Industrial Engineering and Administration *(Engin.),* in Industrial and Labor Relations *(I.L.R.),* and in Plant Breeding *(Ag.).* Provisions for minoring in statistics are given in the sections of this Announcement devoted to the Fields of Industrial Engineering and Operations Research, Industrial and Labor Relations, Mathematics, and Plant Breeding. A brochure on statistics may be obtained by writing to the Cornell Statistics Center, Ives Hall.

Textiles and Clothing (H.E.)

Faculty: C. Baumgartner, M. Humphrey, E. F. McMurry, M. S. Ryan, B. F. Smith, F. M. Spratt, E. E. Stout, M. V. White.

Field Representative: E. E. Stout, 203 Martha Van Rensselaer Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Clothing 2, 3, 4
Textiles 2, 3, 4

Textiles and Clothing 2, 3, 4

Applicants are requested to submit scores of the Graduate Record Examination Aptitude Test.

For students who wish to major or minor in the Field of Textiles and Clothing, a variety of offerings is available both as to course work and opportunities for independent study. No fixed curriculum is prescribed for majors or minors in the Field. Each student's program is planned with and for her individually after consideration of her previous study, her present interests, and her plans for the future. She is encouraged to make use of wide opportunities for study in other Fields and other colleges on campus as well as in this Field. Deficiency in background courses is not necessarily a bar to admission, but it may increase the time needed to earn a degree.

Candidates for a Master's degree in the Field of Textiles and Clothing are expected to have or to acquire a general knowledge of all phases of the Field and an understanding of research methods used in it, and to concentrate in any one of the various branches of the subject.

Such facilities as a conditioning room, textile equipment, and a large collection of historical costumes are available for research. For further information concerning facilities, write to the Field Representative.

On-going research in textiles and psychology of clothing allows for student participation.

Students working toward a Doctor of Philosophy degree in allied Fields may minor in textiles and clothing.

A limited number of teaching and research assistantships are available in the Department.

Water Resources (Ag., Arts, Engin.)

(See pages 142–144.)

BIOLOGICAL SCIENCES*

Agronomy (Ag.)

Faculty: M. Alexander, W. H. Allaway, D. R. Bouldin, N. C. Brady, M. G. Cline, J. E. Dawson, B. E. Dethier, S. N. Fertig, R. Feuer, G. R. Free, W. L. Griffeth, H. B. Hartwig, J. F. Hodgson, W. K. Kennedy, H. A. Kerr, R. E. Krenzin, J. Kubota, D. J. Lathwell, E. R. Lemon, D. L. Linscott, R. F. Lucey, H. A. MacDonald, M. H. Milford, R. D. Miller, W. G. Monson, R. B. Musgrave, M. Peech, T. W. Scott, R. R. Seaney, E. L. Stone, Jr., M. J. Wright, P. J. Zwerman. At Geneva: B. E. Clark, L. W. Nittler.

Field Representative: M. J. Wright, 472 Caldwell Hall.

* Under faculty listings for several of the biological fields of instruction some professors are listed at Geneva. These professors are eligible to serve as co-members of Special Committees of graduate students in connection with the opportunities provided by the New York State Agricultural Experiment Station at Geneva (see page 50).

APPROVED MAJOR AND MINOR SUBJECTS

Field Crop Science 1, 2, 3, 4
Meteorology 1, 2, 3, 4
Seed Technology 2, 3, 4
Soil Science 1, 2, 3, 4

SPECIAL INTERESTS OF THE FACULTY

Field Crop Science and Seed Technology

1. Cereal crops: Professors Krenzin and Musgrave
2. Crop ecology: Professor Musgrave
3. Crop physiology: Professors MacDonald, Monson, Musgrave, Scaney, and Wright
4. Crop preservation and quality: Professors Musgrave and Wright
5. Forage crops: Professors Griffeth, Hartwig, Lucey, MacDonald, Monson, Scaney, and Wright
6. Herbicides, residues, and decomposition: Professors Fertig and Linscott
7. Seed technology: Professors Clark, Fertig, MacDonald, and Nittler
8. Weeds, land and aquatic: Professor Fertig

Meteorology

1. Agricultural climatology and meteorology: Professor Dethier
2. Microclimatology and micrometeorology: Professor Dethier

Soil Science

1. Forest soils: Professor Stone
2. Organic soils: Professor Dawson
3. Soil and water conservation: Professors Free, Kerr, and Zwerman
4. Soil chemistry: Professors Dawson, Hodgson, and Peech
5. Soil fertility: Professors Allaway, Bouldin, Brady, Lathwell, and Scott
6. Soil microbiology: Professor Alexander
7. Soil minerology: Professor Milford
8. Soil morphology, genesis, and cartography: Professors, Cline, Feuer, and Kubota
9. Soil physics: Professors Lemon and Miller

Prospective students are urged to correspond with the professor in the lists given above whose interests are nearest their own, a few months in advance of the time they expect to enter.

POLICIES PECULIAR TO THE FIELD

Students preparing for graduate work in Agronomy are urged to obtain a thorough knowledge of analytical, organic, and physical chemistry, bacteriology, general botany, general physics, genetics, geology, mathematics, and plant physiology. Opportunity will be afforded for further study of some of these subjects after entering the Graduate School, but a student deficient in two or more of these foundation courses cannot expect to receive a degree in the minimum time required for residence. Opportunity to acquire additional experience will be afforded a limited number of students majoring in the Field by summer employment on departmental projects.

Animal Breeding (Ag.)

Faculty: R. W. Bratton, J. H. Bruckner, R. K. Cole, R. H. Foote, C. R. Henderson, D. R. Marble, L. D. VanVleck.

Field Representative: C. R. Henderson, 203 Morrison Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Animal Breeding 1, 2, 4
Animal Genetics 1, 2, 4

Language requirement for the Master's degree: proficiency in French or German is required by Professor Cole. The other professors in this Field usually require one language for the Master's degree if the student expects to become a candidate for the Ph.D. Candidates for the Ph.D. degree may substitute Japanese for French, German, or Russian.

Before entering graduate study in Animal Breeding, the student should have had courses in mathematics, zoology, general biology, comparative anatomy, physiology, and chemistry, and elementary courses in genetics and animal breeding. Some practical experience in animal husbandry, poultry husbandry, or plant breeding is desirable.

Graduate students will be expected to take certain courses in animal physiology, biochemistry, embryology, cytology, genetics, biometry, and histology. One or more of these may be selected as a minor subject.

Graduate studies in Animal Breeding may be taken in several departments of the University, and the student should consult the course offering of each of these departments.

Work in genetics and breeding of large animals, including physiology of reproduction, is offered in the Department of Animal Husbandry under the supervision of Professors Bratton, Foote, Henderson, and VanVleck.

Graduate study in Animal Genetics is offered in the Field of Poultry Science, where work is supervised by Professors Bruckner, Cole, and Marble.

Animal Husbandry (Ag.)

Faculty: D. A. Benton, W. F. Brannon, R. W. Bratton, H. W. Carter, J. M. Elliot, R. H. Foote, W. Hansel, C. R. Henderson, D. E. Hogue, J. K. Loosli, A. M. Meek, W. G. Merrill, J. I. Miller, E. A. Pierce, W. G. Pond, J. T. Reid, G. H. Schmidt, S. T. Slack, S. E. Smith, R. W. Spalding, J. B. Stone, J. R. Stouffer, H. F. Travis, G. W. Trimberger, K. L. Turk, L. D. VanVleck, W. J. Visek, R. G. Warner, G. H. Wellington.

Field Representative: J. K. Loosli, 119 Morrison Hall.

APPROVED MAJOR AND MINOR SUBJECTS *

Animal Breeding 1, 2, 3, 4
Animal Husbandry 1, 2, 3, 4
Animal Nutrition 1, 2, 3, 4
Dairy Husbandry 1, 2, 3, 4

* If the major for the Ph.D. lies in one of these subjects, not more than one of the other three should be selected for a minor.

Although there are no foreign language requirements for the Master's degree, foreign language is recommended for those candidates who expect to go on for the Ph.D. Candidates for the Ph.D. degree may substitute Spanish for French.

To enter graduate study in any of the subjects of Animal Husbandry, the student should have the equivalent of the following courses: animal breeding, elementary feeds and feeding, and the various production courses in dairy and beef cattle, sheep, and swine. He should also have basic courses in animal physiology, bacteriology, biology or zoology, chemistry, genetics, mathematics, organic chemistry, and physics.

In addition to the graduate courses in animal husbandry, candidates for the degrees of M.S. and Ph.D. will be expected to take advanced courses in chemistry, biochemistry, biological statistics, genetics, physiology, and other related subjects.

Animal Nutrition (Ag., Nutr., Vet.)

Faculty: R. H. Barnes, D. A. Benton, C. L. Comar, J. M. Elliot, D. E. Hogue, R. M. Leach, Jr., F. W. Lengemann, J. K. Loosli, L. Lutwak, W. G. Merrill, M. C. Nesheim, W. G. Pond, J. T. Reid, M. L. Scott, B. E. Sheffy, S. E. Smith, H. F. Travis, A. G. van Veen, W. J. Visek, R. G. Warner, R. H. Wasserman, R. J. Young.

Field Representative: R. J. Young, 306 Rice Hall.

APPROVED MAJOR AND MINOR SUBJECT

Animal Nutrition 1, 2, 4

If they do not already possess a reading knowledge of German and either French or Spanish, students expecting to continue their graduate studies should prepare to meet the language requirement for the doctorate during the course of their preparation for the Master's degree.

For graduate study with nutrition as the major subject, the student should have preparation in analytical chemistry, general biology or zoology, genetics, introductory chemistry, organic chemistry, mathematics, physics, and physiology.

In preparation for an advanced degree, candidates according to their special interests may acquire training in biochemistry, calculus, food technology, histology, nutrition, pathology, physiology, and other areas of science and technology. Students are generally advised to select either biochemistry or physiology as a minor for the Master's degree and both of these subjects as minors for the doctorate. However, other minor fields of study may be selected, depending upon the student's interest. Physical chemistry and advanced work in organic chemistry may be required of students particularly interested in the biochemistry of nutrition.

Strong research programs in animal and clinical nutrition are maintained at Cornell University under the direction of members of the Graduate Faculty responsible for the training of graduate students in this Field. A wide latitude is allowed in the selection of the research problem for the degree. If they de-

sire, students may select various phases of established projects which permit them to exercise originality and independence of thinking.

Students in nutrition may be admitted to candidacy for the general degrees (M.S. or Ph.D.) as described above, or the professional degree, Master of Nutritional Science (M.N.S.). A listing and description of courses in the M.N.S. program are to be found in the *Announcement of the Graduate School of Nutrition.*

Animal Physiology (Ag., Arts, Vet.)

Faculty: J. M. Anderson, J. Bentinck-Smith, E. N. Bergman, R. W. Bratton, A. P. Casarett, C. L. Comar, A. Dobson, T. Eisner, R. H. Foote, E. L. Gasteiger, P. W. Gilbert, W. Hansel, F. W. Lengemann, S. L. Leonard, L. Lutwak, K. McEntee, W. N. McFarland, R. S. Morison, L. L. Nangeroni, R. D. O'Brien, R. L. Patton, R. B. Reeves, G. H. Schmidt, A. F. Sellers, C. E. Stevens, D. N. Tapper, A. van Tienhoven, W. J. Visek, R. H. Wasserman, W. A. Wimsatt, J. F. Wootton, R. R. Zimmermann.

Field Representative: A. van Tienhoven, 104 Rice Hall

APPROVED MAJOR AND MINOR SUBJECT

Animal Physiology 1, 2, 4

All English speaking applicants are required to submit the results of the Graduate Record Examination (Aptitude and Advanced Biology Tests).

Language requirement for the Master's degree: passage of the Graduate School requirement in one foreign language. He is normally expected to do this before his final semester of study.

SPECIAL INTERESTS OF THE FACULTY

Behavioral physiology: Eisner, Zimmermann
Comparative physiology: McFarland
Comparative toxicology: O'Brien
Endocrinology: Hansel, Leonard, Lutwak, McEntee, van Tienhoven
Gastro-intestinal physiology: Sellers, Stevens, Wasserman
General and cellular physiology: Reeves
Insect physiology: Eisner, Patton
Invertebrate physiology: Anderson
Lactation: Schmidt
Metabolism: Bergman, Lutwak, Visek
Neurophysiology: Gasteiger, Tapper
Pathological physiology: Bentinck-Smith
Physiological chemistry: Lutwak, Wootton
Radiation biology: Casarett, Comar, Lengemann, Wasserman
Reproduction: Bratton, Foote, Hansel, Leonard, McEntee, van Tienhoven, Wimsatt
Vertebrate physiology: Gilbert, Nangeroni, Sellers, Wimsatt

A prospective student is urged to correspond with the professor in the above list whose interests are nearest his own. This should be done a few months before he expects to enter.

Policies General to the Field

Students preparing for work in the Field of Animal Physiology are urged to obtain a good knowledge of biology, biochemistry, and physics. Calculus, statistics, and genetics are also advisable.

A Ph.D candidate must have at least one minor committeeman who is not a member of the Animal Physiology Field.

One additional member, who will serve in an advisory capacity to the Special Committee, will be appointed by the Field for each Ph.D. and M.S. examination.

Biochemistry (Ag., Arts)

Faculty: R. H. Barnes, L. J. Daniel, J. L. Gaylor, G. P. Hess, R. W. Holley, D. B. McCormick, A. L. Neal, W. L. Nelson, R. D. O'Brien, H. A. Scheraga, F. C. Steward, J. F. Thompson, H. H. Williams, J. F. Wootton, L. D. Wright, R. G. Young. At Geneva: D. B. Hand, F. A. Lee, L. M. Massery, Jr., L. R. Mattick, R. S. Shallenberger, J. P. Van Buren.

Field Representative: W. L. Nelson, B18 Wing Hall.

APPROVED MAJOR AND MINOR SUBJECT

Biochemistry 1, 2, 4

A student desiring to undertake graduate work in the Field of Biochemistry should possess a sound chemistry background and a broad training in the biological and physical sciences. Opportunity will be provided by the extension of the period of graduate study for the candidate to correct minor deficiencies in the above areas. It is recommended that those entering with a strong background in chemistry should choose a biological subject as a minor, and conversely, those with a strong background in biology should choose a branch of chemistry as a minor. The program of study, including the selection of minor subjects, will be governed by the student's background, needs, and interests. By proper selection of minor subjects, the student may focus his graduate study on animal or plant biochemistry but is expected to be proficient in the general Field.

Candidates who choose biochemistry as a minor should have adequate training in chemistry and the biological sciences.

The laboratories at Ithaca are especially equipped for research in analytical methods, enzyme chemistry, food biochemistry (at Ithaca and Geneva), intermediary metabolism, nutritional biochemistry, and plant and animal investigations.

Several assistantships are available both at Ithaca and Geneva each year, and applications for these should be made directly to the Field Representative.

Biology (Ag., Arts)

Faculty: W. L. Brown, Jr., W. S. Cole, W. C. Dilger, T. Eisner, D. J. Hall, W. T. Keeton, R. P. Korf, J. N. Layne, H. E. Moore, Jr., L. L. Pechuman, D. Pimentel, E. C. Raney, R. B. Root, C. H. Uhl, L. D. Uhler, J. R. Vallentyne, J. W. Wells.

Field Representative: L. D. Uhler, 318 Roberts Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Evolutionary Biology 1, 2, 4 General Biology 2, 4

Applicants for graduate study in the Field of Biology must present scores on the Graduate Record Examination Aptitude and Advanced Biology Tests.

Language requirement for the Master's degree: none in general biology, proficiency in one language in evolutionary biology.

EVOLUTIONARY BIOLOGY. Students selecting evolutionary biology as a major or minor subject should be interested in the conceptual framework of biology with emphasis on evolutionary theory. Their research work may be with recent organisms or with the paleontological record. Ordinarily, each student should include on his Special Committee, either as major or minor committeeman, a faculty member who is a specialist in the particular group of plants or animals with which he expects to work.

Members of the faculty in evolutionary biology will be especially interested in directing research in the areas mentioned below, although research will not be limited to these areas: W. L. Brown, general evolutionary theory, experimental systematics, systematics and biology of insects, especially ants; W. S. Cole, systematics and paleoecology, with special reference to Foraminifera; W. C. Dilger, the evolution of behavior; T. Eisner, behavior of invertebrates, the chemical basis of behavior, biocommunication, mimicry; D. J. Hall, experimental population and community dynamics, ecological theory, biology of invertebrates; W. T. Keeton, general evolutionary theory and biology of invertebrates, especially noninsect arthropods, behavior; R. P. Korf, systematics and evolution of fungi, lichens, and mycetozoa; J. N. Layne, the behavior, ecology, and evolution of mammals; H. E. Moore, evolution and systematics of angiosperms, especially Commelinaceae, Gesneriaceae, and Palmae; L. L. Pechuman, biogeography, insect systematics; D. Pimentel, ecology, population dynamics and theory; E. C. Raney, icthyology, especially the behavior, biosystematics, and evolution of fish; R. B. Root, comparative ecology and community organization; C. H. Uhl, chromosomes and evolution; J. R. Vallentyne, biochemical evolution, paleobiochemistry; J. W. Wells, Devonian paleontology, paleoecology and systematics of fossil and recent corals.

GENERAL BIOLOGY. Study toward the Master's degree (M.S.) with General Biology as the major subject is offered for students who are graduates of small colleges, whose subject matter in the biological sciences is limited, and who plan to teach in high schools or small colleges. It involves a continuation of basic courses selected to fill in gaps existing in the students' training. Such students are required to write a standard thesis involving a review of the literature and planned research, or an essay which involves a complete review of the literature on their selected topic. These students usually work under Professor Uhler. Students wishing to study General Biology should also consider the Master of Science for Teachers degree (M.S.T.), with a major in Biology. This is a professional degree (see pages 147–148) based on course work in the sciences and requiring no thesis. Professor Uhler is the adviser for students in this degree program also. Detailed information concerning the M.S.T. degree may be obtained from the Graduate School.

In addition to those primarily interested in high school science teaching, students who wish to pursue research on a problem of a basic biological nature, while at the same time devoting their course work to obtaining a needed broad

background in science, may major in General Biology. These students usually work under Professor Keeton or Professor Eisner. A standard research thesis is required and proficiency in one language is strongly recommended.

Students who plan to do research in some other field of science may select General Biology as a minor to help round out their background.

Botany (Ag.)

Faculty: H. P. Banks, D. M. Bates, D. W. Bierhorst, R. T. Clausen, W. J. Dress, J. W. Ingram, Jr., G. C. Kent, J. M. Kingsbury, R. P. Korf, H. E. Moore, Jr., L. E. Powell, E. M. Shantz, A. M. Srb, F. C. Steward, H. T. Stinson, J. F. Thompson, H. B. Tukey, Jr., C. H. Uhl. At Geneva: W. F. Crosier, J. Einset.

Field Representative: R. P. Korf, 326 Plant Science Building.

APPROVED MAJOR AND MINOR SUBJECTS

Cytology 1, 2, 3, 4
General Botany 2, 4
Paleobotany 1, 2, 3, 4
Phycology 1, 2, 3, 4
Plant Morphology and Anatomy 1, 2, 3, 4
Plant Physiology 1, 2, 3, 4
Plant Taxonomy 1, 2, 3, 4

Language requirement for Master's degree: college entrance French and/or German or proficiency before completion of second residence unit.

GENERAL REQUIREMENTS FOR ALL DEGREES

An adequate knowledge of the structure, functions, and classification of plants is required of all candidates with major subjects in the Field of Botany. Candidates also should have basic training in chemistry, physics, geology, and mathematics.

REQUIREMENTS FOR MAJOR SUBJECTS

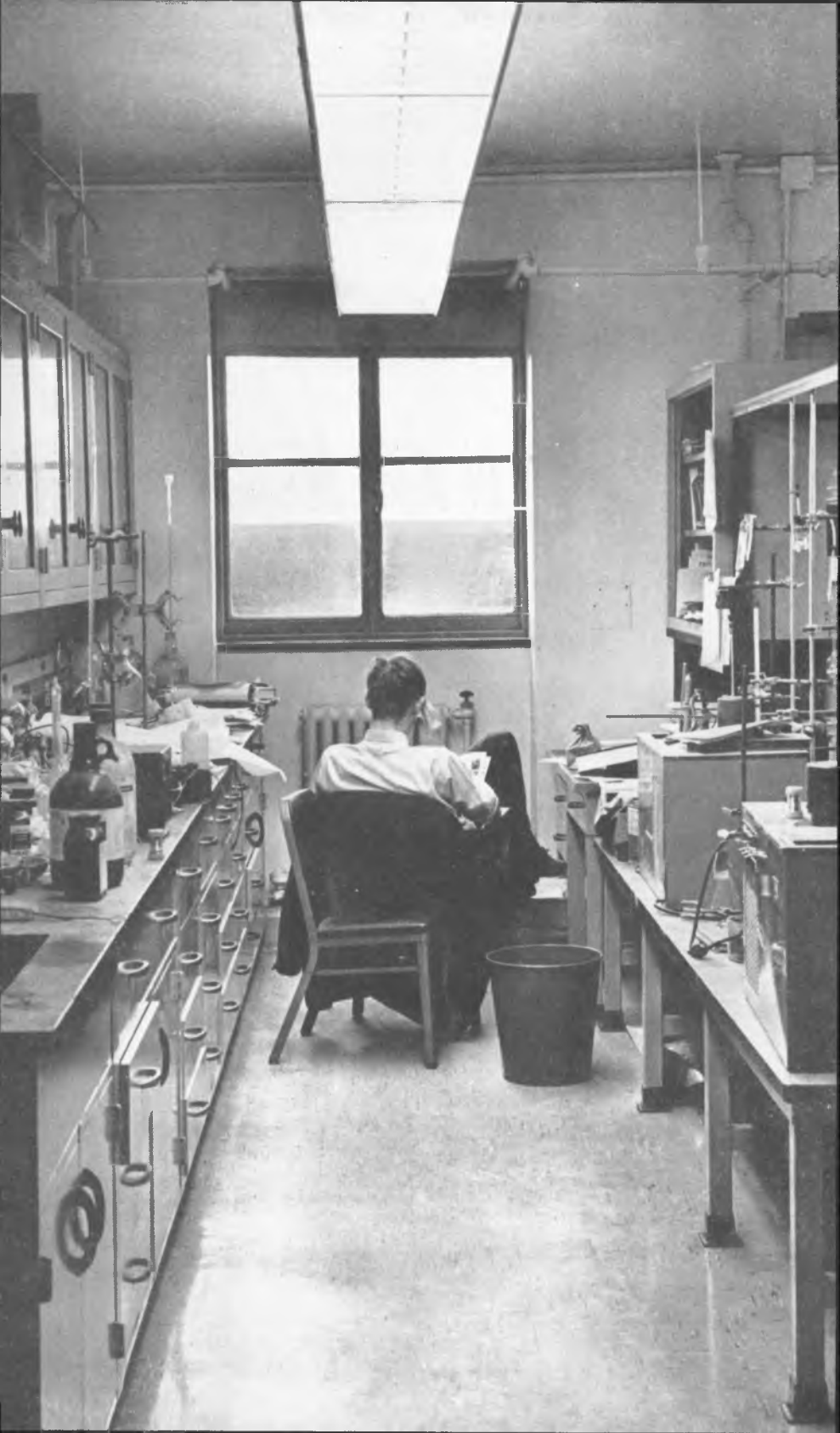
Additional basic requirements for the major subjects are as follows:
CYTOLOGY AND CYTOGENETICS. An adequate knowledge of cytology and two of the following: genetics or plant breeding, plant morphology and anatomy, plant physiology, or plant taxonomy. A. M. Srb, H. T. Stinson, C. H. Uhl.

GENERAL BOTANY. Additional requirements will be determined in each individual case.

PALEOBOTANY. Additional training in plant morphology and anatomy, and adequate knowledge of paleobotany and general stratigraphic geology. H. P. Banks.

PHYCOLOGY. Individual programs stressing mycology, invertebrate zoology, ecology, limnology, plant morphology, plant physiology, taxonomy, cytology, or genetics will be required as appropriate to each student's interests and purposes in studying the algae. J. M. Kingsbury.

Individual study and research are an integral part of the life of every graduate student.



PLANT MORPHOLOGY AND ANATOMY. Additional training in plant morphology and anatomy and plant taxonomy, and adequate knowledge of cytology, genetics, or paleobotany. H. P. Banks and D. W. Bierhorst.

PLANT PHYSIOLOGY. Additional training in plant physiology, and adequate knowledge of chemistry, a general knowledge of mathematics and physics, and training in bacteriology, genetics, mycology, plant pathology, or soils L. E. Powell, E. M. Shantz, F. C. Steward, J. F. Thompson, and H. B. Tukey Jr.

PLANT TAXONOMY. Additional training in plant taxonomy and ecology and an adequate knowledge of genetics and statistics. D. M. Bates, R. T. Clausen, W. J. Dress, J. W. Ingram, Jr., R. P. Korf, and H. E. Moore, Jr.

For Summer Research grants and assistantships in botany at the Museum of Northern Arizona, consult the Field Representative.

Conservation (Ag.)

Faculty: J. P. Barlow, C. O. Berg, W. C. Dilger, W. R. Eadie, A. W. Eipper, J. L. Forney, L. S. Hamilton, O. H. Hewitt, P. P. Kellogg, J. N. Layne, R. R. Morrow, E. C. Raney, H. A. Regier, G. A. Swanson, D. Q. Thompson, D. A. Webster.

Field Representative: W. R. Eadie, 206 Fernow Hall.

APPROVED MAJOR AND MINOR SUBJECT

Fishery Biology 1, 2, 3, 4
Forest Conservation 3, 4
Natural Resources Conservation 1, 2, 3, 4
Oceanography 1, 2, 3, 4
Vertebrate Zoology 1, 2, 3, 4 (including herpetology, ichthyology, mammalogy, ornithology, and comparative vertebrate ethology).
Wildlife Management 1, 2, 3, 4

Applicants for graduate study in the Field of Conservation must submit the results of the Graduate Record Examinations (Aptitude and Advanced Tests).

Language requirement for the Master's degree: college entrance foreign language or six hours of college language.

A doctoral student majoring in the Field of Conservation should choose at least one of his minor subjects from some other Field. A written prequalifying examination is given during the first week of the fall term to all doctoral candidates.

To undertake study in the biological subjects the student should be well prepared in biological sciences and should have or must acquire a foundation in the specialized field of study which he intends to pursue. A strong background in the other biological and physical sciences is highly desirable, and a working knowledge of statistical methods is important in all fields. To undertake graduate study in natural resources conservation, the student must come adequately trained in an existing professional field of study concerned with the management of natural resources, and he must (with only rare exceptions) have professional job experience. Staff members are available to direct graduate study during the regular University Summer Session.

Attention is also directed to the topics of study and courses offered in the Fields of Biology *(Ag.)*, Botany *(Ag.)*, Entomology and Limnology *(Ag.)*, Water

Resources *(Ag., Arts, Engin.)*, and Zoology *(Arts)*. Graduate study in conservation education is directed under the Nature, Science, and Conservation Education program *(Ed.)*.

SPECIAL INTERESTS OF THE FACULTY

Anadromous and marine fisheries management: Professor Raney
Biological acoustics: Professor Kellogg
Comparative vertebrate ethology: Professor Dilger
Forest conservation: Professors Hamilton and Morrow
Freshwater fisheries management: Professors Fipper, Forney, Regier and Webster
Ichthyology: Professor Raney
Mammalogy: Professors Eadie and Layne
Natural resources conservation: Professors Hamilton and Swanson
Nutrition and physiology of fishes: Professor Phillips
Oceanography and marine ecology: Professor Barlow
Ornithology: Professors Dilger and Kellogg
Wildlife management: Professors Hewitt, Swanson, and Thompson

Dairy Science (Ag.)

Faculty: R. H. Deibel, R. F. Holland, W. K. Jordan, F. V. Kosikowski, V. N. Krukovsky, R. A. Ledford, R. P. March, H. B. Naylor, J. W. Sherbon, W. F. Shipe, Jr., J. C. White.

Field Representative: F. V. Kosikowski, 105 Stocking Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Dairy Chemistry 1, 2, 4
Dairy Management 1, 2, 4
Dairy Microbiology 1, 2, 4
Dairy Sciences 1, 2, 4

The Field offers students challenging and interesting study and research opportunities. Students majoring in dairy management may look forward to study and research on the administration of industrial dairy manufacturing complexes and the organization of international milk development projects. Studies leading to minors in economics, business administration, and international agricultural development are encouraged.

Majors in dairy microbiology may elect study and scientific investigations in: food development from milk fermentations; dairy mycology; and laboratory control and administration. Courses in basic microbiology and pathogenic bacteriology will supplement those offered by field faculty.

Students majoring in dairy chemistry have a number of areas of inquiry in which to work such as physiological, biological, organic, and physical chemistry.

Similarly students with a major in dairy science may choose from a variety of specialized activities such as engineering, technology, and sanitary and environmental health, beginning with milk handling practices on the farm and extending to milk processing in the plant.

Well equipped laboratories in the Department of Dairy and Food Science

provide adequate facilities for carrying out the research pertaining to these areas of specialization.

Tuition-free assistantships and fellowships, paying adequate stipends, are available for qualified students. Information regarding these financial aids may be obtained by writing directly to the Field Representative.

Those interested in undertaking a graduate career in this Field should have adequate basic preparation in the area in which they intend to specialize. Prior training in dairy or food science is desirable but not essential, for deficiencies can be made up with satisfactory programing.

In general graduate students are expected to attain a broad mastery of the substance of their major Field and to demonstrate the ability to plan and conduct independent and original research.

Entomology and Limnology (Ag.)

Faculty: C. O. Berg, J. L. Brann, W. L. Brown, Jr., J. E. Dewey, E. J. Dyce, T. Eisner, J. G. Franclemont, G. G. Gyrisco, D. J. Hall, W. T. Johnson, W. T. Keeton, D. J. Lisk, J. G. Matthysse, R. A. Morse, A. A. Muka, R. D. O'Brien, C. E. Palm, R. L. Patton, L. L. Pechuman, J. T. Pennell, D. Pimentel, E. M. Raffensperger, W. A. Rawlins, R. B. Root, B. V. Travis, L. D. Uhler, T. C. Watkins, D. A. Webster, J. A. Wiedhaas, Jr., R. G. Young. Off Campus: J. A. Adams, P. J. Chapman, A. C. Davis, R. W. Dean, F. L. Gambrell, E. H. Glass, S. E. Lienk, P. C. Lippold, F. L. McEwen, G. A. Schaefers, M. Semel, E. F. Taschenberg.

Field Representative: J. G. Franclemont, 305A Comstock Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Apiculture 1, 2, 3, 4
Economic Entomology 1, 2, 3, 4
Entomology 4
Insect Biochemistry 1, 2, 3, 4
Insect Ecology 1, 2, 3, 4
Insect Morphology 1, 2, 3, 4
Insect Pathology 1, 2, 3, 4
Insect Physiology 1, 2, 3, 4
Insect Taxonomy 1, 2, 3, 4
Insect Toxicology 1, 2, 3, 4
Insecticide Chemistry 1, 2, 3, 4
Limnology 1, 2, 3, 4
Medical Entomology 1, 2, 3, 4
Parasitology 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in one language.

Excellent oportunities are offered in the Field of Entomology and Limnology for graduate study in all phases of apiculture, biology (biochemistry, ecology, morphology, physiology, and taxonomy), and/or in the technology of insect control. Emphasis of study and research is on insects and related invertebrates; these are ideally suited for zoological investigations because of their numbers and ease of manipulation in laboratory and nature. The interests of the staff are broad, and they are well qualified to direct study and research in the subjects listed.

To undertake graduate study the student should be well prepared in the fundamentals of biology, chemistry, physics, and certain basic arts and must have or acquire a foundation in the study which he pursues. In the summer members of the staff are available to direct research of graduate students.

Special facilities for study and research include one of the finest entomo-

logical libraries, an extensive insect collection, an insectary, greenhouses, field stations, and numerous well-equipped laboratories. Brochures describing facilities and activities are available from the Field Representative.

Floriculture and Ornamental Horticulture (Ag.)

Faculty: J. W. Boodley, J. F. Cornman, R. T. Fox, R. W. Langhans, R. E. Lee, R. G. Mower, A. M. S. Pridham, R. J. Scannell, J. G. Seeley, H. B. Tukey, Jr.

Field Representative: R. E. Lee, 14 Plant Science Building.

APPROVED MAJOR AND MINOR SUBJECT

Floriculture and Ornamental Horticulture 1, 2, 4

Language requirement for Master's degree: proficiency in either French or German before completion of second residence unit, or a substitute approved by the candidate's Special Committee.

Members of the staff of this Field are concerned with greenhouse crops, nursery crops, turf, plant materials, breeding of ornamental plants, and the problems of landscaping as applied to small properties.

Since many of the problems dealing with greenhouses and nursery crops, turfs, and the breeding of ornamental plants are basically those of plant response with relation to the environment, it is expected that the entering graduate student will have adequate preparation in elementary horticulture, botany, plant physiology, genetics, pathology, agronomy, entomology, mathematics, chemistry, and physics. Studies relating to the physiology, propagation, nutrition, culture, and improvement of ornamental plants may be undertaken as research for an advanced degree and should be approached from the standpoint of the basic sciences. Consequently, it is appropriate to select minor subjects of study from physiology, anatomy, morphology, taxonomy, pathology, genetics, agronomy, entomology, agricultural economics, agricultural engineering, etc.

Studies involving the use of plant materials and problems of design relating to landscape service for small properties may be suitable, in which case it is expected that the student will have an adequate background in the basic principles of horticulture and plant science as well as in design and drawing. Graduate work in design and landscape service is available at the Master's level only.

Graduate students interested in problems concerned with the revision of taxonomic groups of ornamental plants are referred to page 102.

Food and Nutrition (Ag., Arts, H.E., Nutr.)

Faculty: G. D. Armbruster, R. H. Barnes, E. Donald, E. E. Hester, E. J. Kuta, K. Longrée, L. Lutwak, N. Mondy, M. A. Morrison, K. J. Newman, C. J. Personius, J. Rivers, A. G. van Veen, C. M. Young.

Field Representative: Elizabeth A. Donald, 373 Martha Van Rensselaer Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Food 1, 2, 3, 4 Nutrition 1, 2, 3, 4
Food and Nutrition 1, 2, 4

A candidate who wishes to major in this Field and whose previous studies include preparation equivalent to that of an undergraduate major in the Department of Food and Nutrition in the College of Home Economics, i.e., basic courses in food and nutrition, biochemistry, bacteriology, and physiology, may begin graduate studies toward an advanced degree immediately. A student whose preparation is deficient in one or more areas may be required to register as a provisional candidate until he has made up the deficiencies. Preparation in organic and analytical chemistry, physics, and mathematics is strongly recommended.

Students with a major or minor in the Field of Food and Nutrition may select from a variety of courses, seminars, and experiences in independent study. Each student plans his program in consultation with his Special Committee after consideration of his previous background and purpose in graduate study. Minor subjects are selected with the candidate's professional interest in mind. For students with a major in the Field of Food and Nutrition, suggested minors in addition to those within the Field include biochemistry, physiology, bacteriology, botany, statistics, anthropology, sociology, education, and other areas of home economics. Candidates for the Ph.D. degree are expected to select at least one minor in a basic science related to the major.

Members of the staff who direct research studies in food are Professors Armbruster, Hester, Kuta, Longrée, Mondy, and Personius. Members of the staff who direct studies in nutrition are: Professors Barnes, Donald, Lutwak, Morrison, Newman, Rivers, van Veen, and Young.

Inquiries should be addressed to the Graduate Representative, Food and Nutrition, Martha Van Rensselaer Hall, Cornell University.

Food Science and Technology (Ag., Arts, Engin., Nutr.)

Faculty: R. C. Baker, R. H. Barnes, P. A. Buck, R. K. Finn, J. D. Hartman, R. F. Holland, F. M. Isenberg, W. K. Jordan, F. V. Kosikowski, V. N. Krukovsky, R. Ledford, H. B. Naylor, J. E. Nowrey, J. W. Sherbon, W. F. Shipe, Jr., O. Smith, R. M. Smock, J. R. Stouffer, A. G. van Veen, G. H. Wellington, J. C. White. At Geneva: M. C. Bourne, D. F. Farkas, L. R. Hackler, D. B. Hand, R. L. LaBelle, F. A. Lee, L. M. Massey, Jr., L. R. Mattick, J. C. Moyer, C. S. Pederson, W. B. Robinson, R. S. Shallenberger, D. F. Splittstoesser, J. R. Stamer, K. H. Steinkraus, J. P. Van Buren, W. F. Wilkins.

Field Representative: Geneva, L. R. Mattick, Food Science Laboratory;
Ithaca, R. C. Baker, 112 Rice Hall.

APPROVED MAJOR AND MINOR SUBJECT

Food Science and Technology 1, 2, 4

Students planning graduate study in Food Science and Technology should have preparation in one of the following: bacteriology, chemistry, or engineering. It should be noted that the members of this Field are associated with

many different departments of the University. Research on meats, for example, is carried on in the Department of Animal Husbandry; research on potato processing is carried on in the Department of Vegetable Crops. All course work must be taken on the Ithaca campus, but doctoral candidates may elect to conduct their research at the Experiment Station in Geneva where a new pilot plant and laboratory are available. A smaller pilot plant is located on the Ithaca campus, which supplements the research facilities of the departments specializing in raw materials.

In addition to this diversity of facilities, two separate programs are available at the Master's level. Students may be admitted to candidacy for the general degree (M.S.), or for the professional degree, Master of Food Science (M.F.S.).

The M.F.S. program places less emphasis on research and more emphasis on course work. A listing and description of courses in the M.F.S. program are to be found in the *Announcement of the Graduate School of Nutrition.*

Medical Sciences (Graduate School of Medical Sciences)

(See page 145.)

Microbiology (Ag.)

Faculty: M. Alexander, R. H. Deibel, E. A. Delwiche, R. F. Holland, G. Knaysi, R. E. MacDonald, H. B. Naylor, H. W. Seeley, Jr., P. J. VanDemark, S. A. Zahler. At Geneva: C. S. Pederson, D. F. Splittstoesser, J. R. Stamer, K. H. Steinkraus.

Field Representative: P. J. VanDemark, 311 Stocking Hall.

APPROVED MAJOR AND MINOR SUBJECT

Bacteriology 1, 2, 4 (See also Pathogenic Bacteriology 1, 2, 3, 4, page 114.)

Applicants for admission are required to submit scores for the Graduate Record Examination Aptitude Test.

Language requirement for Master's degree: college entrance language.

Students planning graduate study in the Field of Microbiology should have preparation in general chemistry, qualitative and quantitative analysis, organic chemistry, physics, and introductory courses in the biological sciences. In addition, training in physical chemistry and calculus is desirable. Deficiency in any of the subjects listed does not necessarily preclude admission but may increase the time necessary to earn a degree.

Well-equipped laboratories are available. Those branches of microbiological research in which the staff is experienced and especially interested include bacteriophagy, genetics, morphology and cytology, physiology and biochemistry, and systematic and applied bacteriology.

It is to be emphasized that in addition to a creditable performance in the formal program of courses leading to a broad knowledge of bacteriology and related studies, the graduate student registered for an advanced degree is expected to demonstrate ability to plan and conduct independent and original research. The successful culmination of a worthy research project is considered the most important requirement for the Ph.D. degree.

Nutrition (Ag., H.E., Nutr.)

Please consult the *Announcement of the Graduate School of Nutrition.* Interested graduate students should direct their correspondence to Dean Richard H. Barnes, 124 Savage Hall. Also, see page 149 of this Announcement.

Plant Breeding (Ag.)

Faculty: R. E. Anderson, K. Choi, L. V. Crowder, H. L. Everett, W. T. Federer, N. F. Jensen, A. A. Johnson, C. C. Lowe, H. M. Munger, R. P. Murphy, R. L. Plaisted, D. S. Robson, J. Neil Rutger, R. R. Seaney, S. R. Searle, H. T. Stinson, A. M. Srb., N. S. Urquhart, B. Wallace, D. H. Wallace. At Geneva: D. W. Barton, J. Einset, R. C. Lamb, G. A. Marx, D. Ourecky, R. W. Robinson, G. L. Slate, R. D. Way.

Field Representative: N. F. Jensen, 162 Plant Science Building.

APPROVED MAJOR AND MINOR SUBJECTS

Biometry 1, 2, 3, 4
Genetics, 1, 2, *3, 4
Plant Breeding 1, 2,*3, 4

Language requirement for the Master's degree: proficiency in one language consisting of French, German, Spanish, or Russian before completion of the second residence unit, or a substitute approved by the Field of Plant Breeding. Candidates for the Ph.D. may substitute Spanish for French.

Students who are interested in crop improvement through breeding will register in Plant Breeding. Problems for research may involve studies of breeding techniques, the application of genetic principles to breeding, and the correlation of knowlege from other fields in attacks on problems such as yield, quality, adaptability, and disease and insect resistance. The Department now has active research projects with most of the important field and vegetable crops of New York, and certain materials from these projects are available for graduate students problems. For students who will register in genetics, the research problems generally will involve analysis of hereditary and evolutionary phenomena. Almost any suitable biological materials can be utilized, but the most readily available ones will be those currently being studied by the departmental staff in genetic investigations. For those students to whom problems of experimental technique and mathematical analysis of biological data hold the greater appeal, registration will be in biometry.

It is advisable that the student entering upon graduate work in this Field be well grounded in the fundamentals of the natural sciences. He should have had courses in advanced chemistry. biology, calculus, and physics. Students intending to specialize in biological statistics will find it to their advantage to have additional training in mathematics. Training and experience in agriculture are very useful for those planning to specialize in plant breeding.

Students majoring in plant breeding or genetics will find it necessary to remain in Ithaca during the summer, or to make satisfactory arrangements

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* Except that Plant Breeding and Genetics may not be taken as a major-minor or minor-minor combination.

elsewhere for growing and studying the material used in connection with their research problems.

Members of the staff will be especially interested in directing research in the areas listed, although research will not be limited to those areas.

BIOMETRY. K. Choi, statistics; W. T. Federer, statistics and experimental design; D. S. Robson and S. R. Searle, statistics and biometrical genetics.; N. S. Urquhart, statistics and multivariate analysis.

GENETICS. R. E. Anderson, radiation genetics, genetics of higher plants; H. L. Everett, genetics and cytogenetics of maize; A. M. Srb, microbial genetics, physiological genetics; H. T. Stinson, genetics and cytogenetics of Oenothera and maize; B. Wallace, population, evolutionary, and radiation genetics. Staff listed under Plant Breeding direct thesis research on the genetics of the crop plants with which they are primarily concerned. Staff listed under Biometry direct theses on various aspects of statistical and mathematical genetics.

PLANT BREEDING. R. E. Anderson, C. C. Lowe, and R. P. Murphy, forage crops; L. V. Crowder, A. A. Johnson, and J. Neil Rutger, extension and pure seed programs; H. L. Everett, corn; N. F. Jensen, small grains; H. M. Munger and D. H. Wallace, vegetable crops; R. L. Plaisted, potatoes; R. R. Seaney, birdsfoot trefoil.

Prospective students will find it to their advantage to correspond with the staff members whose interests are most closely related to their own some months in advance of the time they wish to apply, since only a limited number of students can be accommodated.

Plant Pathology (Ag.)

Faculty: D. F. Bateman, C. W. Boothroyd, R. S. Dickey, A. W. Dimock, K. D. Hickey, W. T. Johnson, E. D. Jones, G. C. Kent, R. P. Korf, J. W. Lorbeer, W. F. Mai, C. A. Martinson, R. L. Millar, K. G. Parker, L. C. Peterson, W. F. Rochow, A. F. Ross, O. E. Schultz, A. F. Sherf, W. A. Sinclair, L. J. Tyler, R. E. Wilkinson. Off-Campus: A. J. Braun, R. C. Cetas, W. F. Crosier, R. M. Gilmer, J. M. Hamilton, M. B. Harrison, J. J. Natti, D. H. Palmiter, W. T. Schroeder, M. Szkolnik, C. E. Williamson.

Field Representative: A. W. Dimock, 357 Plant Science Building.

APPROVED MAJOR AND MINOR SUBJECTS

Mycology 1, 2, 3, 4 Plant Pathology 1, 2, 3, 4

There is no general foreign language requirement for the M.S.; however, early preparation in one or more foreign languages is expected of all candidates planning to continue to the Ph.D. Demonstration of foreign language competence may be required for the M.S. degree by any member of the Field serving as chairman of a Special Committee.

Excellent opportunities for graduate study and research are offered in all phases of plant pathology. Students become familiar with the basic principles of disease as caused by the major groups of plant pathogens (bacteria, fungi, nematodes, and viruses). Excellent equipment and facilities are available for research under the guidance of specialists in the department. Fields trips

with staff members during the summer give students experience in diagnosing disease and in observing up-to-date control practices. Each student is given a chance to assist with teaching in the elementary course in plant pathology and to become familiar with extension techniques. Students will receive some training in all of the areas of specialization, with opportunity to specialize in one. Applicants should be well prepared in the physical and biological sciences, e.g., botany, chemistry, mathematics, and physics. Opportunity is afforded for further study in these fields, but students with deficiencies cannot expect to complete work for the degree in the minimum period of residence.

Students electing plant pathology as a specialization may work with any of several staff members in specific crop areas, e.g., diseases of forage, fruit, ornamentals, potatoes, vegetables, shade trees and shrubs, small grains, corn, and turf grasses. Students may specialize in diseases caused by bacteria, fungi, viruses, or nematodes. Special programs of training and research are active in all these areas. In addition, special programs are available for root diseases, physiology of disease, and environmental relationships of plant diseases. New laboratories for enlarged programs in nematology, virology, bacteriology, physiology of disease, root diseases, and environmental relationships have recently been completed.

Students interested in fungi will find a stimulating program of research and teaching in mycology. Programs are active in cytology, genetics, morphology, physiology, and taxonomy. Major students concentrate their research in one area. Minor problems are frequently conducted in any of these areas.

When the major is in either mycology or plant pathology, the faculty usually does not advise a minor in the other subject.

An outstanding mycological and plant pathological herbarium, unexcelled library facilities, excellent modern equipment, and cooperation with faculties of related Fields enable students to follow broad research programs.

Several fellowships and scholarships are available, and there are some opportunities for postdoctoral research.

Further information concerning the Field is given in a brochure *Graduate Study in Mycology and Plant Pathology at Cornell,* which may be obtained by writing the Field Representative.

Pomology (Ag.)

Faculty: G. D. Blanpied, L. L. Creasy, L. J. Edgerton, M. B. Hoffman, G. H. Oberly, L. E. Powell, Jr., R. M. Smock, J. P. Tomkins. At Geneva: K. D. Brase, J. C. Cain, O. F. Curtis, Jr., F. G. Dennis, Jr., J. Einset, C. G. Forshey, R. C. Lamb, D. K. Ourecky, N. J. Shaulis, G. L. Slate, R. D. Way.

Field Representative: L. J. Edgerton, 120 Plant Science Building.

APPROVED MAJOR AND MINOR SUBJECT

Pomology 1, 2, 4

Laboratory, greenhouse, orchard, and cold storage facilities at Ithaca and Geneva are available for graduate study. Special facilities for research in fruit breeding, nursery stock investigations, viticulture, and other phases of pomology are also available at Geneva.

Students may minor in such subjects as biochemistry, chemistry, cytology, physics, plant anatomy, plant physiology, soil chemistry, and soil physics. One minor in botany, particularly plant physiology, is urged.

To enter upon graduate work, the student should have the equivalent of the following courses: economic entomology, elementary plant pathology, elementary plant physiology, elementary pomology, general botany, and introductory inorganic and elementary organic chemistry.

Candidates for the Master's degree should spend one summer at Ithaca or Geneva or in the field investigating their special subject. At least two summers of work are expected of candidates for the doctorate.

Poultry Science (Ag.)

Faculty: R. C. Baker, J. H. Bruckner, R. K. Cole, D. R. Marble, M. C. Nesheim, M. L. Scott, A. van Tienhoven, R. J. Young.

Field Representative: J. H. Bruckner, 200 Rice Hall

APPROVED MAJOR AND MINOR SUBJECT

Poultry Science 2, 4

It is recommended that those candidates for the Master's degree who expect to become candidates for the doctorate study one or more foreign languages, preferably French, German, or Russian.

Graduate students minoring in poultry science, or majoring for the degree of M.S. in poultry science, should select appropriate major and minor subjects from the Fields of Animal Breeding, Animal Nutrition, Animal Physiology, and Food Science and Technology.

Graduate students should have had a sound training in zoology or animal biology, physiology, physics, mathematics, and chemistry. It is desirable, but not essential, that the student should have had some training and experience in poultry husbandry.

Psychology (Arts)

Faculty: M. Anisfeld, H. A. Bernbach, U. Bronfenbrenner, R. B. Darlington, W. C. Dilger, E. J. Gibson, J. J. Gibson, H. J. Johnson, W. W. Lambert, H. Levin, R. Longabaugh, R. B. MacLeod, L. Meltzer, T. A. Ryan, H. J. Simmons, O. W. Smith, P. C. Smith, R. R. Zimmermann.

Field Representative: T. A. Ryan, Morrill Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Clinical Psychology 3
Comparative Psychology 1, 2, 3, 4
Differential Psychology and Psychological Tests, 1, 2, 3, 4
Experimental Psychology 1, 2, 3, 4
Experimental Psychopathology 1, 2, 3, 4
General Psychology 2, 4
History of Psychology and Systematic Psychology 1, 2, 3, 4
Industrial Psychology 1, 2, 3, 4
Personality and Social Psychology 1, 2, 3, 4
Physiological Psychology 1, 2, 3, 4

Applicants for admission in psychology are required to submit scores for the Graduate Record Examination (Advanced Test in Psychology and Aptitude Test) and for the Miller Analogies Test.

Language requirement for the Master's degree: proficiency in French, German, or Russian before the final examination.

The research laboratories of the Department of Psychology (*Arts*) are located in Morrill Hall, White Hall, the Liddell Laboratory of Comparative and Physiological Psychology, and the University Industry Research Park. Additional research facilities are provided by the Department of Sociology and Anthropology (*Arts*), the Department of Child Development and Family Relationships (*H.E.*), the School of Education (*Ed.*), and the School of Industrial and Labor Relations (*I.L.R.*). Since much of the graduate instruction and research in psychology is conducted co-operatively, the prospective student should consult the Announcements of each of these departments. A brochure containing additional information is available from the Department of Psychology, Morrill Hall.

Statistics (Ag., Arts, Engin., I.L.R.)

(See page 92.)

Vegetable Crops (Ag.)

Faculty: E. E. Ewing, J. D. Hartman, F. M. R. Isenberg, W. C. Kelly, P. A. Minges, H. M. Munger, J. L. Ozbun, G. J. Raleigh, R. F. Sandsted, R. Sheldrake, O. Smith, R. D. Sweet, L. D. Topoleski, D. H. Wallace. At Geneva: D. W. Barton, M. H. Dickson, G. A. Marx, N. H. Peck, R. W. Robinson, S. Shannon, M. T. Vittum. At Riverhead: S. L. Dallyn, R. L. Sawyer.

Field Representative: R. D. Sweet, 114 East Roberts Hall

APPROVED MAJOR AND MINOR SUBJECT

Vegetable Crops 1, 2, 4

Students expecting to continue their graduate studies should prepare to meet the language requirement for the doctorate during the course of their preparation for the Master's degree. There is no foreign language reading requirement for the M.S.

The language requirement for the Ph.D. is proficiency in two foreign languages, no more than one of which may be chosen from any one of the following four groups: (1) French, Italian, Portuguese, Spanish, (2) Dutch, German, (3) Polish, Russian, (4) Arabic, Japanese.

Research and study in the Field of Vegetable Crops is the application of fundamental scientific knowledge and methods to the solution of the problems of production, handling, and processing in the vegetable industry. Types of work involved include studies of control of flowering and fruiting; development and adaptation of varieties; field plot technique; chemical weed control; the use of plant growth regulators; major and minor element fertilization, irrigation, and other soil management practices; physiological disorders; effects of cultural practices and methods of harvesting, shipping, packaging, storing, and merchandising on quality; taste panel techniques; processing the

potato; development and standardization of objective tests for quality. In many cases students do basic research in physiology, biochemistry, soils, genetics, or the like in attempting to solve problems.

To enter upon graduate work in the Field of Vegetable Crops, it is not necessary for the student to have done his undergraduate work in horticulture. More important, in some cases, is a good background in basic sciences, interest in the plant side of agriculture, and, often, farm experience. It is expected, however, that by the time he has completed his graduate training the student will have a broad knowledge of the whole Field of Vegetable Crops. Work on a Vegetable Crops major may also require a considerable amount of study in certain Fields, such as Statistics, Plant Physiology, or Biochemistry, other than those in which the student is minoring.

The graduate program can provide training for extension or teaching careers as well as for research. Many staff members do either extension or teaching along with research, and they may be selected as members of the Special Committee. Persons now in extension, who desire to take advanced training, especially at Master's degree level, have every opportunity to select courses and thesis problems which will relate to their work. Visits to production areas and marketing centers are encouraged. Assistantships are available that provide experience in extension and in teaching as well as in research.

Members of the staff will be interested in directing research in the subjects listed: Professors Kelly, Minges, Ozbun, and Sandsted, vegetable crop physiology and production; Professors Barton, Dickson, Marx, Munger, Robinson, and Wallace, breeding genetics, and variety performance; Professor Sweet, chemical weed control; Professor Isenberg, postharvest physiology, biological aspects of handling and marketing vegetables; Professor Hartman, biological and food technological aspects of marketing, objective and subjective measurement of color, flavor, and texture; Professor Sheldrake, plant growing structures and methods; Professor Smith, potatoes: physiology of production and storage, factors affecting and methods of measuring cooking and processing quality; Professor Topoleski, youth extension work; Professor Vittum, climatology and soil-plant-water relationships; Professor Peck, mineral nutrition, fertilization and cultural practices; Professor Shannon, biochemistry, nutrition, and physiology; Professor Raleigh, mineral nutrition, muck studies, breeding; Professors Dallyn and Sawyer, potatoes: blackspot, storage, sprout inhibitors, cooking quality; other vegetables: cultural methods, fertilization, irrigation, chemical weed control; Professor Ewing, potatoes: seed value, sprouting abnormalities, irrigation, physiology of disease resistance.

Veterinary Medicine (Vet.)

Faculty: M. Anders, A. L. Aronson, J. A. Baker, J. Bentinck-Smith, E. Bergman, C. I. Boyer, D. W. Bruner, B. Calnek, L. E. Carmichael, A. P. Casarett, C. L. Comar, G. Danks, D. D. Delahanty, A. de Lahunta, A. Dobson, R. H. Dunlop, H. E. Evans, J. Fabricant, F. H. Fox, E. L. Gasteiger, J. R. Georgi, J. H. Gillespie, R. E. Habel, R. W. Kirk, L. P. Krook, K. M. Lee, F. W. Lengemann, E. P. Leonard, P. P. Levine, K. McEntee, L. L. Nangeroni, N. L. Norcross, M. C. Peckham, G. C. Poppensiek, C. G. Rickard, S. J. Roberts, O. W. Sack, A. F. Sellers, B. E. Sheffy, C. E. Stevens, D. N. Tapper, J. C. Thompson, Jr., R. H. Wasserman, J. H. Whitlock, A. Winter, J. Wootton.

Field Representative: J. H. Gillespie, C320 Veterinary College

APPROVED MAJOR AND MINOR SUBJECTS

Animal Physiology 1, 2, 3, 4
Immunochemistry 1, 2, 3, 4
Parasitology 1, 2, 3, 4
Pathogenic Bacteriology 1, 2, 3, 4
Physical Biology (including Radiation Biology) 1, 2, 3, 4
Veterinary Anatomy 1, 2, 3, 4
Veterinary Medicine 1, 2, 3, 4
Veterinary Obstetrics and Diseases of the Reproductive Organs 1, 2, 3, 4
Veterinary Pathology 1, 2, 3, 4
Veterinary Pharmacology 1, 2, 3, 4
Veterinary Surgery 1, 2, 3, 4
Veterinary Virology 1, 2, 3, 4

Applicants for graduate study from countries other than the United States and Canada are requested to include in their credentials the results of the Graduate Record Examination (Aptitude) Test except in cases where his examination is not given in reasonable proximity to the student's home. When the Graduate Record Examination is not available, the student is requested to submit, instead, the results of the College Entrance Board Examination (Scholastic Aptitude Tests).

For the Master's degree a reading knowledge of an appropriate language of scholarship (for example, German, Russian, and French or Spanish) is desirable but not required.

Facilities for graduate study and research in all fields of basic and applied veterinary medicine offer many unique opportunities. In addition to the excellent University libraries, the College has a specialized collection of over 33,000 volumes and 570 current periodicals. A large and varied clinic representing all domesticated animals is available as a source of material. In addition to the animal quarters, pastures, and laboratories on the main campus, the College operates several farms and research facilities within close proximity. These include the virus disease laboratories, poultry disease facilities, sheep and cattle disease farms, and the radiation biology laboratory.

Graduate students may work for the M.S., PhD., or D.Sc. in V.M. (Doctor of Science in Veterinary Medicine). The latter degree is characterized by a professional rather than a research objective. (See the *Announcement of the Veterinary College* for a full description of the requirements.) A student who holds the D.V.M. degree from a recognized college in the U.S. or Canada may transfer one year's residence credit for that work toward the Ph.D. degree. In the clinical fields only candidates with the D.V.M. degree are accepted for graduate work.

ANATOMY: Professors de Lahunta, Evans, Habel, Sack.

Facilities are provided for graduate study in all branches of the science of anatomy as they pertain to domestic and laboratory animals and wild vertebrates. Study and research are encouraged in other fields of veterinary science and animal biology which employ morphological techniques in the determination of experimental results. Graduate students have the opportunity to gain valuable experience and stimulation by taking part in teaching activities.

The basic requirements for a major in veterinary anatomy include: (1) satisfactory completion of the professional courses in gross, microscopic, developmental, and neuroanatomy of the domestic animals, or equivalent formal instruction; (2) participation in the departmental seminars; (3) advanced course work selected from the offerings of the University to suit the special objectives of the student; (4) a thesis which gives evidence of a thorough review of the literature and a competent treatment of the research problem.

AVIAN DISEASES: Professors Calnek, Fabricant, Levine, Peckham.

There are excellent facilities at Ithaca for research in avian diseases. On the campus a fully equipped building holding 41 tight, isolation pens for poultry is in operation. A poultry disease research farm is located on Snyder Hill, about three miles from the campus. There, a disease-free breeder flock is maintained for production of fertile eggs and chickens. Many small isolation buildings are available for work with the less contagious diseases. Fully equipped laboratory facilities exist at the Veterinary College and at the research farm. Material is available from the poultry disease diagnostic laboratory at the Veterinary College and from the four regional branch diagnostic laboratories which serve the poultry industry in the state.

The Veterinary College, in cooperation with the Long Island Duck Research Cooperative, Inc., operates a fully equipped diagnostic and research laboratory for duck diseases at Eastport, Long Island. Living quarters at the laboratory are available for graduate students and investigators.

LARGE ANIMAL MEDICINE, OBSTETRICS, AND SURGERY: Professors Danks, Delahanty, Fox, McEntee, Norcross, Roberts, Winter.

Courses are offered covering the general subjects of medicine, obstetrics, radiology, and surgery. The patients in the Ambulatory Clinic, the Large Animal Surgical Clinics, and the Mastitis Control Program supply an abundant source of valuable research material that is studied in cooperation with other departments in the College. This is particularly true in bacteriology, virology, parasitology, pathology, neurology, and metabolic diseases.

The department has strong research programs in mastitis, especially in the field of immunochemistry, and in reproductive disease of cattle. Two experimental herds of cattle are available for research in these areas.

The graduate program is designed to provide training in research methods in preparation for a career in teaching or research.

MICROBIOLOGY: Professors Baker, Bruner, Carmichael, Gillespie, Lee, Poppensiek, Sheffy.

The laboratories are well equipped with modern apparatus providing opportunity for advanced work, for those students who are properly prepared, in pathogenic microbiology, immunity, immunochemistry, and virology.

PATHOLOGY: Professors D. W. Baker, Bentinck-Smith, Boyer, Krook, Rickard, Whitlock.

The laboratories are well equipped for advanced work in pathological anatomy, histochemistry, parasitology, tissue culture, and electron microscopy. The department operates diagnostic facilities in which a large number of specimens for pathological, microbiological, and serological examinations are submitted. Principal emphasis is placed on necropsy and clinical pathology, nutritional pathology, parasite ecology, laboratory animal disease, and cancer research.

PHYSICAL BIOLOGY: Professors Casarett, Comar, Gasteiger, Lengemann, Tapper, Thompson, Wasserman.

Master's degree and doctoral candidates may be accepted with a major in physical biology or radiation biology. Emphasis is given to the development and application of physical methods and concepts to problems of normal and abnormal metabolism. Excellent facilities are available for work with laboratory and domestic animals and especially in all aspects of the use and effects of radiation. Some of the areas presently under active research include: fission

product metabolism in animals; radiation effects with emphasis on central nervous system response; biomedical dosimetry; mineral metabolism; use of radioisotopes in biological research and in clinical diagnosis; problems of radioactive contamination of the food chain.

Candidates are expected to have a strong background in biological sciences and either to have had, or to be in a position to take, during their first year, the equivalent of the following courses: elementary physical chemistry, elementary physics, biometry, and calculus.

It is recommended that those candidates for the Master's degree who expect to become candidates for the doctorate study one or more foreign languages.

PHYSIOLOGY: Professors Anders, Aronson, Bergman, Dobson, Nangerom, Sellers, Stevens, Wootton.

Opportunities are offered for pursuit of graduate study toward the M.S. and Ph.D. degrees in the areas of physiological chemistry, physiology, and pharmacology. Areas of active research include enzyme kinetic studies, absorption from the digestive tract, carbohydrate and fat metabolic studies in ruminants, chelation of heavy metals in the animal body, chelate toxicity, electro- and chemical narcosis, electrolyte metabolism in digestive tract disease in ruminants, and gastric blood flow.

The M.S. degree is advised prior to undertaking work for the Ph.D. in the majority of instances. The minor subjects for the Masters' and Ph.D. degrees are taken in departments outside the Field of the major.

SMALL ANIMAL MEDICINE AND SURGERY: Professors Kirk, Leonard.

Graduate students may elect to work for the M.S. degree, the Ph.D. degree, or for the D.Sc. in V.M. Special subjects of study include general and advanced canine medicine, general canine surgery, canine orthopedic surgery, and breeding diseases of small animals. Basic work in any one of these special fields will be reviewed, and advanced work will be given on an assignment basis. Minor subjects are required in one or more areas of the basic sciences.

Because of the close integration of the Small Animal Clinic with the department, it is possible for the graduate student to have access to research material for whatever project he might like to undertake. The facilities are adequate for graduate study and research through the cooperation of other departments within the College.

Only candidates with the degree of D.V.M. or its equivalent are accepted, and the language requirement for the various degrees is the same as that required in the general Field of Veterinary Medicine.

Water Resources (Ag., Arts., Engin.)

(See pages 142–144.)

Zoology (Arts)

Faculty: H. B. Adelmann, J. M. Anderson, A. W. Blackler, L. C. Cole, P. W. Gilbert, S. L. Leonard, W. N. McFarland, R. B. Reeves, J. R. Vallentyne, W. A. Wimsatt.

Field Representative: J. M. Anderson, 106 Stimson Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Animal Cytology 1, 3
Biogeochemistry 1, 2, 3, 4
Comparative and Functional Anatomy 1, 2, 3, 4
Comparative and Cellular Physiology 1, 2, 3, 4
Comparative Neurology 1, 2, 3, 4
Ecology 1, 2, 3, 4
Endocrinology 1, 2, 3, 4
Histology and Embryology 1, 2, 3, 4
Invertebrate Zoology 1, 2, 3, 4

Applicants for admission to graduate study in Zoology must submit scores of the Graduate Record Examination Aptitude and Advanced Biology Tests. It is important that the examination be taken as early as possible in the year of application and that scores be submitted not later than mid-March.

Language requirement for the Master's degree: proficiency in French, German, or Russian, to be established before the completion of the second residence unit.

The Field of Zoology offers excellent opportunities for graduate study and research in all phases of zoology, but particularly in the descriptive and experimental aspects of the following special subjects: (1) comparative and human anatomy, with emphasis on the functional approach, (2) comparative and cellular physiology, (3) general ecology, (4) endocrinology, (5) histology and embryology, (6) invertebrate zoology, (7) comparative and general neurology, and (8) limnology and biogeochemistry. Members of the staff are especially qualified to direct research in the subjects listed, but research need not be limited to these subjects. The research interests of the members of the staff are broad; in general, they may be summarized as follows: H. B. Adelmann, experimental embryology and the history of embryology; J. M. Anderson, general and comparative anatomy of invertebrates, with emphasis on the functional histology and histochemistry of organ systems; A. W. Blackler, origin of sex cells and nucleo-cytoplasmic interaction in development; L. C. Cole, general ecology with special emphasis on population phenomena and the mathematical theory of populations; P. W. Gilbert, vertebrate functional anatomy, i.e., correlation of habits and activities of vertebrates with their morphology, biology of elasmobranch fishes with special emphasis on reproductive patterns and sense organs; S. L. Leonard, general endocrinology with special emphasis on the anatomical, physiological, and biochemical aspects of the mechanisms of hormone action, reproduction, growth, and metabolism; W. N. McFarland, comparative physiology, osmotic and ionic regulation, respiration with special emphasis on its relationship to environmental control, and the physiology of fishes; R. B. Reeves, cellular physiology and biochemistry, with special emphasis on mechanisms of metabolic control in cells performing contractile, secretory, and synthetic work; J. R. Vallentyne, limnology, biogeochemistry of organic matter, and the origin of life; W. A. Wimsatt, histology, histophysiological and histochemical approach to problems of reproduction, comparative placentation, and hibernation.

All applicants should have completed the equivalent of a well-rounded college major in zoology and should have some foundation in the particular phase of zoology they desire to pursue. Courses in organic chemistry and elementary physics should also have been completed. Although an exceptional student may be admitted without having finished one or more of these requirements, he should then expect to remain in residence beyond the minimum period to make up the deficiencies.

In addition to the courses offered by the Field of Zoology *(Arts)*, other courses of study that are often valuable to graduate students (either as individual courses or as minor subjects) are: chemistry (especially organic and physical chemistry), geology, mathematics, psychology, and physics *(Arts);* bacteriology, biochemistry, botany, conservation, entomology, genetics, statistics (Field of Plant Breeding), and physiology of reproduction (Field of Animal Husbandry) *(Agr.);* and physiology and physical biology *(Vet.)*.

For summer research grants and assistantships in zoology at the Museum of Northern Arizona consult the Field Representative.

PHYSICAL SCIENCES

Aerospace Engineering (Engin.)

Faculty: P. C. T. de Boer, A. George, I. Imai, G. S. S. Ludford, E. L. Resler, Jr., W. R. Sears, A. R. Seebass, S. F. Shen, D. L. Turcotte.

Field Representative: E. L. Resler, Jr., 290 Grumman Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Aerospace Engineering 1, 2, 3, 4 Aerodynamics 4

In this Field of graduate study emphasis is placed on the aerospace sciences rather than proficiency in present-day techniques. Consequently, graduate students having aerospace engineering as their major subject will be urged to select as their minor subjects the basic sciences, such as chemistry, mathematics, mechanics, and physics.

Much of the research carried out in this Feld at Cornell is concerned with fundamental problems in the dynamics of fluids, including plasmas and chemical reactions at high temperature. Whenever possible, these investigations combine the techniques of theory and laboratory experiment, making use of the experimental facilities of the Graduate School of Aerospace Engineering on the campus. In every investigation, an attempt is made to correlate theory with observation and practical experience.

A group working under the direction of Professors de Boer and Resler is investigating the dynamics of gases at extreme temperatures. Generally speaking, their interests lie in matters in which the sciences of physics and chemistry are finding application to the aerodynamics of propulsion systems and to flight of missiles and space vehicles.

The branch of fluid mechanics called magnetohydrodynamics now forms an essential part of the School's activities; Professors Resler, Sears, and Turcotte are engaged in this research, both in theory and in the laboratory. This interest brings the School into close contact with several other departments of the University (including the Center for Applied Mathematics and the Center for Radiophysics and Space Research). Professors George, Seebass, and Shen and their students are pursuing investigations in the area of rarefied-gas dynamics, hypersonics, basic fluid mechanics, and advanced aerodynamics, which are related to the other aspects of real-gas dynamics and air chemistry mentioned above. The School also maintains active interest and research in subjects basic to modern space vehicle and propulsion-system design, including problems of missile dynamics, trajectories, and orbits. Research in chemical

kinetics is conducted with the cooperation of Professor S. H. Bauer of the Chemistry Department, and research in structures and materials is carried out in cooperation with the Field of Theoretical and Applied Mechanics and the Materials Sciences Center. This brief description is, of course, not all-inclusive and other topics of research are under study; further details may be obtained by writing to the Director of the Graduate School of Aerospace Engineering.

Candidates for an advanced degree with a major in this Field who do not already hold the Master's degree are encouraged to matriculate first as candidates for the professional degree, Master of Engineering (Aerospace), under the jurisdiction of the Graduate School of Aerospace Engineering. Information concerning this School and the degree of Master of Engineering (Aerospace) will be found in the *Announcement of Engineering Courses and Curricula*. It is not recommended that candidates apply for admission at mid-year, except in very unusual circumstances.

Agricultural Engineering (Ag., Engin.)

Faculty: R. D. Black, E. W. Foss, O. C. French, R. B. Furry, R. W. Guest, W. W. Gunkel, F. G. Lechner, G. Levine, R. T. Lorenzen, D. C. Ludington, E. D. Markwardt, W. F. Millier, G. E. Rehkugler, N. R. Scott, E. S. Shepardson, J. C. Siemens, J. W. Spencer, C. N. Turner.

Field Representative: W. F. Millier, 208 Riley-Robb Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Agricultural Engineering 1, 2, * 3, 4
Agricultural Structures 1, * 3, 4
Electric Power and Processing 1, * 3, 4
Power and Machinery 1, * 3, 4
Soil and Water Engineering 1, * 3, 4

Candidates for the Ph.D. degree may substitute Dutch or Swedish for German.

An applicant for admission as a candidate for an advanced degree in this Field must hold a Bachelor's degree with specialization in agricultural engineering or its equivalent. In addition, he should have a scholarship ranking in at least the upper one-third of his class. A general knowledge of agriculture also is essential.

A thesis based on a research effort is required. The candidate has considerable freedom in choosing a thesis project. Minor work usually is taken in the engineering, agricultural, or basic sciences, depending upon the student's interests and needs. Students majoring in other Fields are invited to minor in one of the approved subjects in Agricultural Engineering. Specific courses are listed in the *Announcements of the Colleges of Engineering, of Agriculture, and of Arts and Sciences.*

Information in regard to the types of Agricultural Engineering research projects and departmental facilities is available in the brochure *Graduate Engineering at Cornell University* obtainable from the Office of the College of Engineering.

* These are generally approved only for the Ph.D. and not for the M.S. if the major is in one of the above subjects.

Applied Mathematics (Arts, Engin.)

Faculty: R. P. Agnew, H. D. Block, R. W. Conway, N. DeClaris, R. Farrell, W. H. J. Fuchs, L. Gross, D. L. Iglehart, F. Jelinek, H. Kesten, J. C. Kiefer, J. A. Krumhansl, G. S. S. Ludford, T. P. Mitchell, A. Nerode, L. E. Payne, H. S. Sack, E. E. Salpeter, D. Sather, W. R. Sears, A. R. Seebass, F. L. Spitzer, R. J. Walker, B. Widom, J. Wolfowitz.

Field Representative: W. R. Sears, 275 Olin Hall.

APPROVED MAJOR SUBJECT

Applied Mathematics 1, 2, † 4

Graduate students will be admitted to study in this Field from a variety of educational backgrounds, including the several branches of engineering and the physical and biological sciences as well as mathematics. Their programs of study will include advanced courses in pure mathematics, thorough grounding in mathematical methods, and studies of subject areas in which significant applications of mathematics are made.

The thesis in Applied Mathematics must be a mathematical contribution toward the solution of a problem arising outside mathematics.

At the time of the qualifying examination for the Ph.D. (or the final examination for the Master's Degree), candidates in this Field must demonstrate knowledge of advanced calculus (including both theoretical and applied aspects), vector calculus, and the fundamentals of modern algebra. All candidates must gain a sound command of "mathematical methods," i.e., applied mathematical analysis. Course work in mathematical analysis is also recommended.

Ph.D. candidates must reach the level of proficiency in one of the broad subject areas of the Field of Mathematics (analysis, algebra, geometry). Each candidate must also acquire familiarity with significant applications of advanced mathematics; such applications can be studied at Cornell in several areas, such as the various branches of engineering science, physics, and chemistry.

The minor subjects for candidates whose major subject is applied mathematics should be chosen in consultation with the major adviser from those available in the biological, engineering, physical, and social sciences. One minor subject will usually be chosen in an area close to the thesis. The choice of an area within mathematics as a minor is not excluded, but the work done in this minor subject must be in addition to that done toward the fulfillment of the general mathematical requirements mentioned above.

Applied Physics (Arts, Engin.)

Faculty: J. Ballantyne, R. W. Balluffi, B. W. Batterman, J. M. Blakely, H. G. Booker, K. B. Cady, D. D. Clark, M. H. Cohen, F. T. Cranch, P. C. T. de Boer, L. F. Eastman, D. E. Fisher, T. Gold, P. L. Hartman, J. P. Howe, H. H. Johnson, J. A. Krumhansl, C. Y. Li, R. L. Liboff, P. R. McIsaac, M. Nelkin, E. L.

† Ordinarily the minor subject for candidates whose major subject is in engineering or science should be mathematics. Applied mathematics will be available as a minor subject only in unusual cases when a minor in mathematics does not meet the educational objectives.

Resler, T. N. Rhodin, A. L. Ruoff, H. Sack, B. M. Siegel, J. Silcox, R. Sudan, C. L. Tang, A. Taylor, D. L. Turcotte, G. Wade, W. W. Webb, G. J. Wolga.

Field Representative: G. J. Wolga, 312 Phillips Hall.

APPROVED MAJOR AND MINOR SUBJECT

Applied Physics 1, 2, 4

Graduate study in the Field of Applied Physics offers an opportunity to those students who wish to achieve proficiency in mathematics and physics in order to study and do research in areas of applied science and engineering, emphasizing the application of physics principles and techniques. It allows a student with an engineering background to become more proficient in physics and mathematics and offers opportunities to a student with a physics undergraduate training to branch out into the applied sciences.

A student can choose for his thesis research any Field of specialization as long as the approach to his project is compatible with the over-all objectives of the Field of Applied Physics as stated above. Staff members of the Field are currently interested in directing research in the following areas.

APPLIED THEORETICAL PHYSICS: Electromagnetic theory, applications of irreversible thermodynamics, transport theory in plasmas and solids; applications of existing theory to the calculation of band structure and thermodynamic properties of solids, quantum electronics, atomic basis of hydrodynamics in normal and superfluids, molecular theory of liquids.

BIOPHYSICS: Use of electron microscopy in the study of large protein molecules and high resolution autoradiography applied to studies in cell biology.

NUCLEAR PHYSICS: Low energy nuclear physics, neutron physics, instrumentation, activation analysis and mass spectrometry applied to meteorites.

OPTICS: Solid and gaseous lasers, coherence properties of lasers, electron optics, development of high resolution electron microscopy, contrast effects in electron microscopy, X-ray and electron diffraction, non-linear optics.

PLASMA PHYSICS: Experimental and theoretical studies, magnetohydrodynamics, electron dynamics at microwave frequencies, instabilities.

RADIATION AND MATTER: Interaction of microwave and optical frequency radiation with gaseous and solid state matter (with applications to electronics), radiation damage, characteristic energy losses of electrons passing through thin solid films.

SOLID STATE PHYSICS: Perfect and imperfect crystals, point and line imperfections, diffusion and conduction, dislocation mechanics, internal friction, electronic properties of metals, ionic crystals and semiconductors, superconductivity, ferromagnetism, electron spin resonance.

SPACE PHYSICS: Atmospheric and ionspheric investigations, physical phenomena in astronomy and astrophysics.

SURFACES AND THIN FILMS: Nucleation and growth phenomena, epitaxy, interfacial phenomena in liquids and solids, physical properties of thin films.

Additional general information is available in a booklet titled *Graduate Study in Engineering at Cornell.* Interested students should write to the Office of the Dean of the College of Engineering, Carpenter Hall.

A brochure with more details about research possibilities and graduate programs in the Field of Applied Physics is available by writing to the Field Representative, Applied Physics, Rockefeller Hall.

Astronomy and Space Sciences (Arts, Engin.)

Faculty: W. I. Axford, R. Bolgiano, M. H. Cohen, T. R. Cuykendall, J. P. Delvaille, F. D. Drake, D. E. Fisher, T. Gold, W. E. Gordon, K. I. Greisen, M. Harwit, F. Jelinek, T. P. Mitchell, B. Nichols, E. L. Resler, Jr., G.-C. Rumi, H. S. Sack, E. E. Salpeter, W. R. Sears, R. W. Shaw, R. N. Sudan, G. Wade, L. S. Wagner.

Field Representative: E. E. Salpeter, 308 Newman Laboratory.

APPROVED MAJOR AND MINOR SUBJECTS

Astronomy 1, 2, 3, 4
Astrophysics 1, 2, 3, 4
Magnetohydrodynamics 1, 2, 3, 4
Radiophysics 1, 2, 3, 4
Space Sciences (General) 2, 4

Language requirement for the Master's degree: proficiency in French, German, or Russian is desirable. Students taking astronomy or astrophysics as a major subject will be required to pass the proficiency test in one of these languages before the end of the third term of residence.

The major and both minor subjects for the doctorate should not all be chosen in this Field.

Students may come to this Field with a strong background in astronomy, electrical engineering, engineering physics, mathematics, or physics.

Members of the staff are particularly interested in directing graduate research in the following subjects:

ASTRONOMY AND ASTROPHYSICS: Cosmic rays, cosmology, dynamics of the interstellar gas, geodetic astronomy, lunar photometry, solar system magnetohydrodynamics, stellar spectroscopy, theory of stellar structure, stellar evolution, nuclear processes in stars, stellar statistics.

ATMOSPHERIC AND IONOSPHERIC RADIO INVESTIGATIONS: Dynamics of the atmosphere and ionosphere; incoherent electron scattering; study of refraction, scattering, attenuation due to the inhomogeneous nature of the troposphere and ionosphere; theory and observation of propagation of radio waves in ionized media such as the ionosphere.

RADIO ASTRONOMY: Distribution and classification of radio sources, radar investigations of the moon and planets, solar radio observations; studies of gaseous nebulae.

SPACE VEHICLE INSTRUMENTATION: Instrumentation relating to lunar exploration, magnetic field measurements, tenuous gas and particle flux measurements; infrared observations from rockets.

Graduate students in this Field may be connected with the Cornell University Center for Radiophysics and Space Research. Many members of the faculty

listed above are members of this Center, which possesses or is planning important facilities for geophysical and solar system investigations both by radio methods and by space vehicle instrumentation. Further details of this organization and facilities can be obtained by writing to the Secretary, Cornell University Center for Radiophysics and Space Research, Clark Hall of Science. See also pages 44–46.

The recently formed Cornell-Sydney University Astronomy Center, an international cooperative venture in the Field of Astronomy and Space Sciences, provides students and faculty members of the two universities with an opportunity to work together in the Field. The Sydney University facilities include the Criss-Cross and Mills Cross radio telescopes, the stellar intensity interferometer, detectors for very high energy cosmic rays, and plasma and nuclear physics laboratories. Further details can be obtained by writing to the Secretary, Astronomy Department, Clark Hall of Science. See also pages 46–47.

Chemical Engineering (Engin.)

Faculty: G. G. Cocks, R. K. Finn, P. Harriott, J. E. Hedrick, J. P. Leinroth, Jr., C. W. Mason, F. Rodriguez, G. F. Scheele, J. C. Smith, R. G. Thorpe, R. L. Von Berg, H. F. Wiegandt, C. C. Winding, R. York.

Field Representative: C. C. Winding, 124 Olin Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Biochemical Engineering 1, 3
Chemical Engineering,
General 1, 2, 3, 4
Chemical Processes and Process Control 1, 3, 4
Materials Engineering 1, 3, 4
Nuclear Process Engineering 1, 3

To qualify for admission, a student must have completed satisfactorily the equivalent of the fundamental work required by an accredited curriculum in chemical engineering. Outstanding students who have received a baccalaureate degree with a major in chemistry will also be considered for admission. Normally an extra year of residence is required of such students to make up work in engineering fundamentals.

Candidates for either the Master's or the Doctor's degree must choose one minor outside the Field. Candidates for the Doctor's degree select the other minor and the major from approved subjects within the Field. Minor subjects may be chosen in many other Fields, e.g., the Fields of Business and Public Administration, Chemistry, Engineering, Industrial and Labor Relations, Mathematics, or Physics.

Candidates are expected to pursue a course of study and research that will give them a deeper comprehension of the basic and applied sciences and will develop initiative, originality, and creative ability. To achieve this goal the student participates in graduate courses and seminars and must complete an original, individual investigation for a thesis. Theses may involve either experimental research or special projects in such subjects as design, economics, and mathematical analysis. Specific programs are planned to fit the objectives of the student and to develop original thinking. An arbitrarily fixed series of courses is not required, but each student is expected to acquire a strong back-

ground in applied mathematics, chemical processes, rate and mass transfer processes, reaction kinetics, and thermodynamics.

Graduate courses are offered in biochemical engineering, chemistry and technology of rubbers and plastics, economics, materials, nuclear engineering, process control, rate and mass transfer processes, reaction kinetics, and thermodynamics. Research work for a thesis may be in any of these same areas.

Chemistry (Arts)

Faculty: A. C. Albrecht, S. H. Bauer, A. T. Blomquist, J. M. Burlitch, R. A. Caldwell, W. D. Cooke, K. G. Farnum, R. C. Fay, J. Freed, D. H. Geske, M. J. Goldstein, G. G. Hammes, R. E. Hester, J. L. Hoard, R. Hoffman, R. E. Hughes, A. W. Laubengayer, J. E. Lind, Jr., F. A. Long, J. Meinwald, W. T. Miller, G. H. Morrison, R. A. Plane, R. F. Porter, H. A. Scheraga, M. J. Sienko, D. A. Usher, B. Widom, C. F. Wilcox, Jr., J. J. Zuckerman.

Field Representative: C. F. Wilcox, 326 Baker Laboratory.

APPROVED MAJOR AND MINOR SUBJECTS

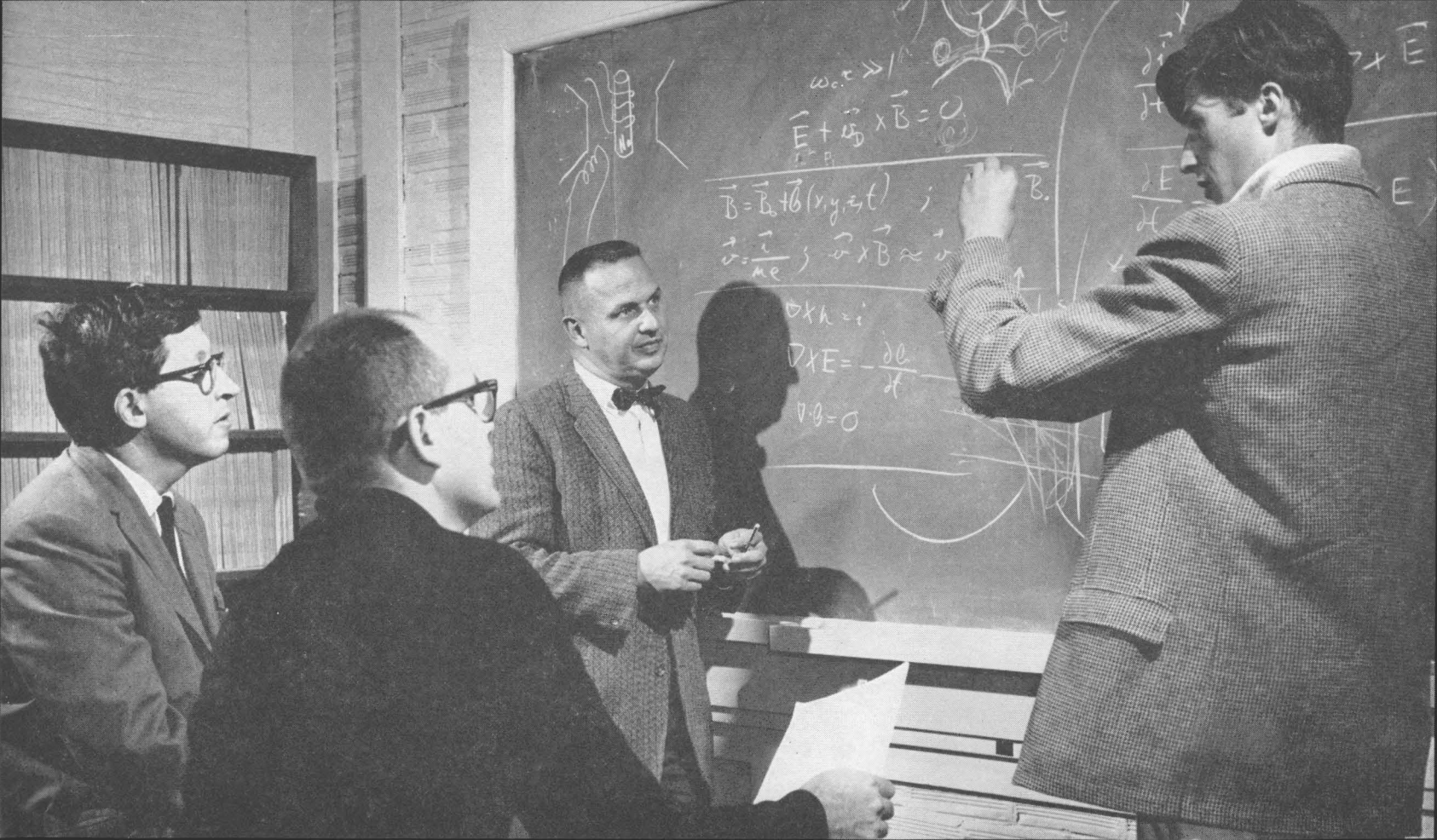
Analytical Chemistry 1, 2, 3, 4
Bio-organic Chemistry 1, 2, 3, 4
Biophysical Chemistry 1, 2, 3, 4
Inorganic Chemistry 1, 2, 3, 4
Organic Chemistry 1, 2, 3, 4
Physical Chemistry 1, 2, 3, 4
Theoretical Chemistry 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in French, German, or Russian, or an approved substitute to be demonstrated upon admission; if satisfaction of the language requirement is delayed, an additional semester of residence is required.

Language requirement for the Ph.D. degree: proficiency in German and in French or Russian.

The program of graduate study in the Field of Chemistry is designed to give a broad training in the fundamental knowledge of chemistry and in methods of research. A graduate student will ordinarily pursue these objectives by taking advanced courses, by participation in organized and informal seminars and discussions with his associates and faculty members, and by carrying out and reporting on a research project in his major subject. Special opportunities are provided by (1) the Materials Science Center at Cornell which supports several research assistantships for graduate students in chemistry, and (2) a National Institutes of Health Training Grant which similarly provides trainee stipends for work in bio-organic and biophysical chemistry. Upon completion of their study program, graduates normally go out to positions in research laboratories or to positions involving teaching and research.

Candidates for the degree of Master of Arts, Master of Science, or Doctor of Philosophy with a major in chemistry will be expected to offer for admission the equivalent of an A.B. degree with a major in chemistry. Such training should include courses in general chemistry, mathematics, organic chemistry, physical chemistry, physics, and qualitative and quantitative analysis. Some experience with foreign languages, preferably German and either French or Russian, is also regarded as essential. In admitting students, emphasis is placed on quality of performance and promise for research as judged by those best acquainted with applicants. Unusually promising students may be admitted with deficiences in undergraduate training. In such cases work designed to



make up the deficiencies will be required, and more than the usual period of residence may be necessary.

Proficiency tests will be required of all entering candidates for advanced degrees (M.S. or Ph.D.) with a major in chemistry. These tests are given a few days before registration for the fall term and cover the divisions in analytical, inorganic, organic, and physical chemistry. Each test will be about two and one-half hours in length and will cover material normally presented in elementary courses in the subjects listed above. The results of these tests will be used to aid the student's Special Committee in the planning of his program of study. While the results will not be considered in the usual sense of "passing" or "failing," low marks in one or more of the tests may require a preponderance of elementary courses during a term.

Graduate students are encouraged to carry on research during part of the summer, and a number of Summer Research fellowships are available for this purpose.

Graduate students are required to register with the Department of Chemistry on the registration days at the beginning of each term. Entering students will consult with the chairman of the departmental Graduate Scholarship Committee at this time.

In addition to the courses in chemistry *(Arts)*, attention is directed to courses in biochemistry *(Agr.)*, chemical engineering, including chemical microscopy *(Engin.)*, and mathematics and physics *(Arts)*.

A graduate student who desires to take a minor subject in chemistry with a major subject from some Field other than chemistry will be required to offer or acquire a satisfactory background for advanced work. This will ordinarily consist of an introductory course in general chemistry and of intermediate courses prerequisite to advanced work in the minor subject in chemistry. The work in his minor subject in chemistry comprises advanced study planned with the approval of his Special Committee.

Specific inquiries from prospective graduate students are welcomed and should be addressed to the Field Representative or to any member of the faculty. Applications for teaching or research assistantships should be addressed to the Chairman of the Department of Chemistry, Baker Laboratory.

Civil Engineering (Engin.)

Faculty: V. C. Behn, D. J. Belcher, G. H. Blessis, W. Brutsaert, N. A. Christensen, M. I. Esrig, G. P. Fisher, C. D. Gates, P. Gergely, W. H. Graf, W. L. Hewitt, T. D. Lewis, T. Liang, J. A. Liggett, W. R. Lynn, G. B. Lyon, W. McGuire, A. J. McNair, A. H. Nilson, W. L. Richards, F. O. Slate, R. N. White, G. Winter, D. A. Woolhiser.

Field Representative: J. A. Liggett, 117 Hollister Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Aerial Photographic Studies 2, 3, 4
Construction Engineering and Administration 2, 3, 4
Geodetic and Photogrammetric Engineering 1, 2, 3, 4
Hydraulic Engineering 2, 3, 4
Hydraulics 1, 2, 3, 4
Sanitary Engineering 1, 2, 3, 4
Sanitary Sciences 3, 4
Soils Engineering 1, 2, 3, 4
Structural Engineering 1, 2, 3, 4
Structural Mechanics 3, 4
Transportation Engineering 1, 2, 3, 4
Water Resources Engineering 1, 3, 4,

In order to be admitted for graduate study in the Field of Civil Engineering, an applicant should hold a Bachelor's degree in engineering, mathematics, or the physical sciences from an institution of recognized standing. In addition, he should have a high undergraduate scholastic record and show promise for advanced study.

Civil Engineering offers a variety of instruction including formal courses, seminars, and individual instruction. Graduate study is aimed at preparing the students for a career in either engineering practice or basic and applied research. These dual objectives are accomplished respectively by offering engineering project courses whereby the student can do supervised design, and also by a large number of research projects in which the student can investigate unknown areas of engineering.

Additional information on specific programs is available by writing to the Field Representative, School of Civil Engineering. Study and research is usually carried on in one of the following areas:

CONSTRUCTION ENGINEERING AND ADMINISTRATION: This subject permits students to pursue studies that relate more particularly to the role of the civil engineer in construction and business and in the administration of private and public works. Programs may be arranged to suit the student's background and objectives. In general, emphasis is placed on preparing the student in modern quantitative methods that can aid the engineer-manager in determining the most advantageous course of action to take under a given set of conditions.

GEODETIC AND PHOTOGRAMMETRIC ENGINEERING AND AERIAL PHOTOGRAPHIC STUDIES: A complete coverage of this area of interest is afforded by advanced courses in survey engineering (topography, land and cartographic engineering); theoretical and observational geodesy; instrumental and analytical photogrammetry; map projections; error theory and adjustment of observations; and photo interpretation which are offered in the School. Advanced courses in mathematics and physics which are offered by other departments augment this coverage. The laboratory facilities available to students in this area include: a broad cross-section of modern optical tooling equipment, levels, theodolites, a projection type stereoplotter, and a world-wide collection of aerial photography.

Sponsored research projects provide opportunities for student participation in research. Partial financial support for qualified students is available through some of these projects as well as through teaching assistantships.

HYDRAULICS AND HYDRAULIC ENGINEERING: A complete sequence of advanced courses is offered in theoretical and experimental hydraulics, covering the subjects of hydrodynamics, advanced hydraulics, flow in open channels, experimental and numerical methods, hydrology, flow in porous media, river and harbor engineering, and free surface flow. Formal teaching is supplemented by informal discussions, demonstrations, laboratory experiments, and field trips. Seminars are held regularly with the participation of the staff, of graduate students, and of distinguished visitors.

Experimental facilities are available in the Hollister Hall Hydraulics Laboratory and in the Cornell Applied Hydraulics Laboratory on Beebe Lake. These facilities provide adequate space and instrumentation for research activities in all phases of hydraulics.

Many forms of financial aid are available including fellowships, trainee-

ships, research assistantships, teaching assistantships, and laboratory assistantships.

SANITARY ENGINEERING: Advanced study is offered in the theoretical and applied aspects of the analysis and design of water and waste-water treatment processes, in the application of systems analysis methodology to the analysis and design of water quality control and other environmental systems, and in water resources engineering.

Laboratories are equipped for instruction and research in the microbiology and chemistry of water, and in the engineering aspects of water quality control.

Sponsored research projects and graduate training grants make possible student participation in a variety of research problems and provide financial support in the form of fellowships and research assistantships.

SOILS ENGINEERING: Graduate programs are designed to provide a sound theoretical foundation which the student may expand in accordance with his needs and interests. Formal instruction covers the broad topics of theoretical soil mechanics, foundation engineering, the behavior of soils, and the laboratory evaluation of soil properties. Informal study of special topics and problems through special courses, seminars, and directed research is encouraged.

A large, modern, well-equipped laboratory is available for teaching and research. Special equipment has been constructed to study (a) the stress distribution during triaxial shear, (b) the effects of plane strain and the rotation of the principal stresses on the shear strength of soils, and (c) the effects of electrokinetic phenomena on the properties of soils.

The Department of Soil Engineering regularly employs graduate students on sponsored research projects and as teaching assistants.

STRUCTURAL ENGINEERING: Structural engineering embraces not only the more conventional aspects of civil engineering design but also other structural work, such as aeronautical and space structures, nuclear engineering structures, tanks, bins, pressure vessels, antenna towers, and the like. Emphasis is placed on the common fundamental background, theoretical and experimental, of all structural engineering. To this end, a rounded training is given in advanced structural analysis; theories of elasticity, plasticity, and stability; and physical behavior of materials and structures under static and dynamic load.

Complete facilities for experimental structural research of all kinds are available including a structural testing hall 50 feet by 80 feet in plan, and 45 feet high for full-scale, three-dimensional static and fatigue testing of structures; static- and fatigue-testing machines of a variety of capacities; appropriate measuring equipment; and a laboratory for structural model analysis. The University's computing center is available for structural analysis and research.

The department is continually engaged in structural research sponsored by various government and industrial organizations. In addition to research assistants on these sponsored research projects, the Department of Structural Engineering annually employs several graduate students as teaching assistants. These positions should be of special interest to prospective college teachers.

TRANSPORTATION ENGINEERING: Formal offerings and graduate research covered by the department are contained in four major subareas: (1) engineering interpretation of aerial photographs and physical environment evaluation; (2) traffic engineering and urban planning; (3) civil engineering materials, to include bituminous materials and mixtures as well as portland

cement concrete; and (4) planning, design, and construction of transportation facilities.

Three modern laboratories are maintained in which graduate training and research are conducted. The Cornell Center for Aerial Photographic Studies maintains files of over 80,000 photographs showing worldwide coverage of soil, rock, and drainage patterns of arid, humid, arctic, and tropic areas. In addition to the usual equipment, the Concrete and Aggregate Laboratory contains specialized research tools such as a precision petrographic microscope and a complete industrial X-ray installation. The Transportation Laboratory is fully equipped for bituminous material and mixture research. In addition to these, graduate students in transportation have access to other facilities such as Soil and Structural Laboratories, University Research Library, and the Computing Center.

The staff offers instruction in various branches of aerial photographic studies: engineering soil studies, construction planning, ground water, mineral surveys, etc. The offerings in traffic engineering are complemented by those in the Field of City and Regional Planning. Considerable emphasis is placed upon field work and practical experience. Research activities in all areas of transportation have in the past provided numerous graduate study opportunities in tropical soil analysis, flexible pavement design, aerial photos in highway planning and the like.

Students on leave from professional assignments may adjust their programs to fit their special interests and research problems.

WATER RESOURCES ENGINEERING: This area offers an opportunity to develop competence in water quality control, hydraulics and hydrology, and in the applications of economics and systems analysis methodologies to the solution of engineering problems encountered in water resources planning and management.

Computer Science (Engin., Arts)

Faculty: R. W. Conway, C. F. Hockett, W. L. Maxwell, A. Nerode, L. E. Payne. C. Pottle, S. Saltzman, S. R. Searle, R. J. Walker.

Field Representative: R. W. Conway, Upson Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Computer Science 1, 2, 3, 4
Information Processing 1, 2, 3, 4
Numerical Analysis 1, 2, 3, 4

There is no Field requirement of a foreign language for the Master's degree, but in appropriate cases individual faculty may require this proficiency of one of their advisees.

The Field of Computer Science at Cornell includes not only the fundamental theoretical material in automata, computability, and language structure but also such subjects as numerical analysis and information processing, which underlie broad areas of computer application. A graduate student should consider a major in computer science if he is primarily interested in how a particular problem is solved on a computer and how this process can be generalized and related to other computer work. If he is primarily interested in the result of a computer process and its relation to a particular area of application, then he should major in another Field and consider a minor in computer science.

A student majoring in numerical analysis would be concerned with computer methods for solving mathematical problems. Whereas students who are primarily interested in the mathematical theory of numerical analysis would have their major in the Field of Mathematics, students concerned with problems and techniques of implementing computer solutions to mathematical problems would have majors in the Field of Computer Science.

Formal coursework in computer science includes such topics as programing theory and languages, computer logic and organization, general theory of automata, artificial intelligence, information retrieval, simulation, and data processing. This is supplemented by appropriate courses in other areas such as engineering, mathematics, statistics, linguistics, etc.

As prerequisite for candidacy in this Field, a student is expected to have had significant experience in programing a digital computer, and depending upon the particular subject major chosen, appropriate background in mathematics, engineering, linguistics, etc., to permit the immediate enrollment in graduate level courses. A student is also expected to have had at least an introductory course in computer science although this deficiency can be remedied after admission.

All candidates for the Ph.D. are required to have at least one minor in a Field other than computer science. The most frequent choices would be in the Fields of Mathematics, Applied Mathematics, Statistics, Industrial Engineering and Operations Research, Electrical Engineering, Biology, Psychology, or Linguistics, but others would be possible. For a candidate whose major subject is numerical analysis, a minor in mathematics or applied mathematics is required.

Many of the courses and much of the research in the Field involve the facilities of the Cornell Computing Center. At present the Center operates a Control Data 1604 with a 160A as satellite peripheral processor. There are no outside commitments on this machine so that its full capacity is available to Cornell staff and students. IBM 1401 and 1410 equipment and an analog computing facility are also available.

A booklet describing in more detail the graduate work at Cornell in computer science and closely related subjects can be obtained by writing to the Field Representative, Upson Hall.

Electrical Engineering (Engin.)

Faculty: P. D. Ankrum, J. M. Ballantyne, R. Bolgiano, N. H. Bryant, M. H. Cohen, G. C. Dalman, N. DeClaris, L. F. Eastman, W. H. Erickson, A. S. Gilmour, T. Gold, W. E. Gordon, C. E. Ingalls, F. Jelinek, M. Kim, K. R. Kleckner, R. L. Liboff, S. Linke, L. A. MacKenzie, H. S. McGaughan, P. R. McIsaac, T. McLean, C. W. Merriam, W. E. Meserve, S. K. Mitra, B. Nichols, R. E. Osborn, C. Pottle, J. L. Rosson, G. C. Rumi, H. G. Smith, E. M. Strong, R. N. Sudan, C. L. Tang, J. S. Thorp, H. C. Torng, N. M. Vrana, G. Wade, L. S. Wagner, H. R. Witt, G. J. Wolga, S. W. Zimmerman.

Field Representative: W. E. Meserve, Phillips Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Communication Engineering 1, 2, 3, 4
Control Systems Engineering 1, 2, 3, 4
Electrical Engineering, General 1, 2, 3, 4
Illuminating Engineering 2, 3, 4
Power Engineering 1, 2, 3, 4

Though the Graduate Record Examination is not required of applicants in the Field of Electrical Engineering, applicants are urged to take this examination, submitting its results along with their application for graduate work.

As prerequisite for graduate work leading to the degree of M.S. or Ph.D. with a major in the Field of Electrical Engineering, the candidate should have had the equivalent of the fundamental work required by an accredited undergraduate curriculum in the area of his major subject. The candidate must also supply definite evidence of scholarly interest and aptitude for advanced study.

Considerable latitude is allowed in the selection of the minor subjects, provided that the entire program shows a unified purpose.

Adequate work in advanced physics and mathematics is required of candidates for the degree of Ph.D. It is highly recommended that at least one of the two minor subjects be chosen in the Fields of Physics or Mathematics or in other related Fields outside the Field of Electrical Engineering.

The approved major and minor subjects listed above define broad areas in the Field of Electrical Engineering within which a student may plan a graduate program which best suits his needs. In addition to the formal courses listed in the *Announcement of Engineering Courses and Curricula,* members of the faculty are prepared to guide individual students in special topics and to arrange seminars for students interested in closely related lines of study and research. Proficiency is expected in all phases of the graduate program.

Members of the faculty in the Field of Electrical Engineering are especially interested in directing graduate research in the following areas:

COMMUNICATION ENGINEERING: Acoustics, communications systems, information theory, physical and microwave electronics, radio wave propagation.

CONTROL SYSTEMS ENGINEERING: Analog and digital computers, feedback control systems, industrial electronics, switching systems.

ELECTRICAL ENGINEERING, GENERAL: Applied mathematics, biomedical electronics, electric network theory, electrical measurements, ionospheric studies, magnetohydrodynamics, materials science in electrical engineering, physics of maser and laser systems, plasma studies, radio astronomy, satellite instrumentation.

ILLUMINATING ENGINEERING: Illumination design, light sources, optics, vision and color.

POWER ENGINEERING: Electric power conversion, electrical breakdown phenomena, electrical machinery, ionized gases in electromagnetic fields, magnetohydrodynamics, power systems analysis.

It is not desirable, nor is it intended, that the boundaries between these areas within the Field of Electrical Engineering be too rigidly defined. Rather, every effort is made to allow each student to pursue a program designed to give him a period of broad advanced study. To this end work in such subjects as applied physics, astronomy, biological science, engineering materials, fluid mechanics, or thermodynamics may be considered as partially fulfilling the requirements for a major or minor in Electrical Engineering, even though these subjects are not under the direct jurisdiction of the faculty of the School of Electrical Engineering.

Geography

Students interested in graduate work in geography will find study programs in many aspects of this subject in several Fields described in this Announcement. Graduate degrees are not offered in the subject of geography as such, but advanced study in geography is made possible by informally combining study in the constituent elements of the subject by arrangement with faculty members listed below.

Agricultural Geography: Prof. John W. Mellor
Anthropology: Prof. Lauriston Sharp
Climatology: Prof. Bernard E. Dethier
Geology: Prof. Arthur L. Bloom
Land Economics: Prof. Howard E. Conklin
Rural Sociology: Prof. Olaf F. Larson
Sociology: Prof. J. Mayone Stycos
Soil Science: Prof. Marlin G. Cline

Correspondence with members of the faculty in the student's special subject of interest is encouraged.

Geology and Geography (Arts)

Faculty: A. L. Bloom, W. S. Cole, G. A. Kiersch, E. S. Lenker, W. E. LeMasurier.

Field Representative: W. S. Cole, 425 McGraw Hall

APPROVED MAJOR AND MINOR SUBJECTS

Areal Geology 1, 2, 3. 4
Engineering Geology and Hydrogeology 1, 2, 3, 4
Geomorphology 1, 2, 3, 4
Mineral Deposits 2, 3, 4
Mineralogy, Petrology, and Geochemistry 1, 2, 3, 4
Paleontology and Stratigraphy 1, 2, 3, 4
Physical Geography 1, 2, 3, 4
Structural Geology 1, 2, 3, 4

Applicants for graduate study in geology should take the Graduate Record Examination Aptitude Test and Advanced Test in Geology in sufficient time to permit inclusion of the results in the application for admission to the Graduate School.

Language requirement for the Master's degree: proficiency in French, German, or Russian, to be established before the completion of the second residence unit.

Language requirement for the Ph.D. degree: proficiency in French and in German or Russian.

The program of graduate study in the Field of Geology is designed to give broad training in the field and laboratory. Candidates for advanced degrees normally will take one or both minor subjects outside of the Field of Geology. Minor subjects may be chosen from many Fields, such as Agronomy, Botany, Engineering, Chemistry, Mathematics, Physics, Water Resources, Zoology, or non-scientific Fields. Graduate work in Geology may

include investigation under approved direction in localities away from Ithaca.

A brochure about graduate work in Geology may be obtained by writing to the Field Representative.

Candidates with a major in this Field will be expected to offer for admission an A.B. degree or its equivalent with an undergraduate major in geology similar to that at Cornell University (see the *Announcement of the College of Arts and Sciences*). Students with other undergraduate majors may be admitted, but deficiencies in geology must be removed by appropriate course work soon after admission.

The Ithaca region is particularly suited for research in stratigraphy, paleontology, geomorphology, and glacial geology. The nearby Adirondack area is a classic one for studies in metamorphic and igneous petrology. Research projects in structural geology, and engineering geology and hydrogeology are available at field sites in western as well as northeastern states. The laboratories of the Department contain standard as well as specialized equipment.

For Summer Research grants in geology at the Museum of Northern Arizona and elsewhere, consult with the Field Representative.

SPECIAL INTERESTS OF THE FACULTY

Analytical geochemistry and petrology: Professor Lenker
Coastal geomorphology and Pleistocene geology: Professor Bloom
Engineering geology, geomechanics, and hydrogeology: Professor Kiersch
Invertebrate paleontology and geomorphology: Professor Cole
Invertebrate paleontology and paleoecology: Professor Wells
Volcanic petrology and geochemistry: Professor LeMasurier

Industrial Engineering and Operations Research (Engin.)

Faculty: R. N. Allen, R. E. Bechhofer, R. H. Bernhard, R. W. Conway, H. P. Goode, D. L. Iglehart, W. L. Maxwell, S. Saltzman, M. W. Sampson, B. W. Saunders, A. Schultz, Jr., H. M. Taylor III, L. Weiss.

Field Representative: R. E. Bechhofer, 356 Upson Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Applied Probability and Statistics 1, 2, 3, 4
Engineering Administration 4
Industrial Engineering 1, 2, 3, 4
Information Processing 2, 3, 4
Operations Research 1, 2, 4
Systems Analysis and Design 1, 2, 3, 4

It is recommended that all applicants to the Field of Industrial Engineering and Operations Research take the Graduate Record Examination and submit the results along with their application for graduate work.

The following restrictions are placed on major-minor combinations when the major is in the Field of Industrial Engineering and Operations Research: (1) A minor in industrial engineering may be elected only if the major is applied probability and statistics or information processing, (2) a minor in systems analysis and design may be elected only if the major is applied probability and statistics or information processing.

Candidates for the Ph.D. degree must choose at least one minor outside the Field. The most common choices are mathematics (Field of Mathematics), econometrics (Field of Economics), computer science (Field of Computer Science), and managerial economics (Field of Business and Public Administration). The selection of a minor subject from one of the other engineering fields is also strongly encouraged.

As a prerequisite for graduate study leading to the degree of M.S. or Ph.D. with a major in the Field of Industrial Engineering and Operations Research, the candidate must have been graduated from an institution of recognized standing with a Bachelor's degree in engineering, mathematics, or the physical sciences. In addition, he must have a commendable undergraduate scholastic record and must supply other evidence of his interest in, and ability to pursue, advanced study and research in his major and minor subjects.

One of the major concerns of the Field of Industrial Engineering and Operations Research is with the analysis and design of types of integrated systems involving men, machines, and materials.

APPLIED PROBABILITY AND STATISTICS. The subject of applied probability and statistics should be selected by those students whose primary interests are in the methodology of probability and statistics, particularly insofar as these techniques are applied to problems arising in engineering and science. The technique areas emphasized are those associated with the statistical aspect of the design, analysis, and interpretation of engineering experiments; statistical quality control, sampling inspection, and reliability theory; statistical decision theory; applied stochastic processes (for example, queuing theory, inventory theory, and time-series analysis). Students who elect work in this subject are expected to acquire a deep knowledge of the theory underlying the various techniques; the doctoral dissertation should represent a fundamental contribution to theory and application. All students who major in applied probability and statistics are required to minor in mathematics *(Arts)* and to include in their program courses in probability and statistics offered by the Department of Mathematics; additional courses in statistics are found among the offerings of the Department of Plant Breeding *(Ag.)* and the School of Industrial and Labor Relations *(I.L.R.)*. Study in this subject is closely coordinated with the activities of the Cornell Statistics Center.

ENGINEERING ADMINISTRATION. The subject of engineering administration is concerned with the problems encountered in organizing and directing engineering groups and their activities, and in the administrative practices and procedures employed.

INDUSTRIAL ENGINEERING. Students concentrating in industrial engineering are usually interested in studying the analysis and design of the complex operational systems that occur in industry, particularly in manufacturing. Their studies include work in the functional areas of plant design, cost analysis and control, and production planning. They are expected to achieve a high degree of facility with some of the modern analytical techniques which provide tools for rational decision-making and which aid in the establishment of valid design criteria; these techniques are drawn from such areas as inventory theory, queuing theory, mathematical programing, quality control, and computer simulation.

INFORMATION PROCESSING. The subject of information processing is concerned with the analysis and design of systems, the functions of which

are to record, transmit, store, and process information. Emphasis is placed on the application and integration of equipment rather than on the design of machines. Areas of interest include systems for information retrieval, manufacturing control, traffic control, and data processing systems. The facilities on the Ithaca campus consist of a Control Data 1604 with satellite 160A; an IBM 1410; and an IBM 1401; all four are magnetic-tape oriented systems. Work done in this area is closely related to some aspects of work done in the Field of Computer Science.

OPERATIONS RESEARCH AND SYSTEMS ANALYSIS AND DESIGN. Students concentrating in operations research or in systems analysis and design are interested in problems which are similar to those studied by the industrial engineer; however, these problems tend to be more analytical in character, and are not restricted to those of industry. Thus the student may, for example, be concerned with air or highway traffic control systems, military operations research, or research in institutional (for example, hospital) operations; industrial problems include those associated with services, distribution, and marketing as well as manufacturing. Students who elect operations research or systems analysis and design as major subjects are usually highly oriented analytically. Their studies emphasize a broad range of problem-solving methodology of a mathematical, statistical, or computational nature. Their research may be concerned with the development of new methodology, the use of standard methodology in a new application, or a combination of these.

A booklet containing additional information for the entering graduate student about graduate work and research in this Field can be obtained by writing to the Graduate Field Representative. Also, the brochure *Graduate Engineering at Cornell University* is available from the Office of Engineering, Carpenter Hall.

Materials Science and Engineering (Engin.)

Faculty: R. W. Balluffi, B. W. Batterman, M. Blakely, M. S. Burton, E. T. Cranch, T. R. Cuykendall, D. Dropkin, J. L. Gregg, D. F. Holcomb, J. P. Howe, J. O. Jeffrey, H. H. Johnson, J. A. Krumhansl, C. Y. Li, J. B. Newkirk, T. N. Rhodin, A. L. Ruoff, H. S. Sack, E. Scala, B. M. Siegel, M. J. Sienko, J. Silcox, F. O. Slate, G. V. Smith, R. L. Sproull, A. Taylor, R. L. Von Berg, W. W. Webb, C. C. Winding, G. Winter, G. J. Wolga.

Field Representative: H. H. Johnson, Thurston Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Materials and Metallurgical Engineering 1, 2, 3, 4
Materials Science 1, 2, 3, 4

It is recommended that the applicant present the results of the Graduate Record Examination with his application.

Graduate studies in the Field of Materials Science and Engineering are aimed at preparing the student for a career in basic or applied research and development, or engineering applications in the area of materials, both metallic and nonmetallic. Since the need for materials satisfying very stringent requirements is rapidly growing, requiring novel approaches, and

since our scientific understanding of engineering properties is in a state of fast development, it is imperative that a student acquire a firm foundation in the appropriate basic sciences, such as crystal physics, microstructure, thermodynamics, kinetics, etc., as well as in the modern techniques of experimental research (light, X-ray and electron metallography; measurements based on electromagnetic and nuclear phenomena, at low and high temperatures, in high vacuum, and at high pressure, etc.). For this purpose, a core program of courses in the basic and applied sciences on an advanced level has been designed, which together with an advanced laboratory will prepare the student for his thesis research and for specialized courses in the area of his particular interest.

The wide variety of research interests of the faculty, spanning a broad range from immediate engineering application (e.g., crack propagation in steel) to "pure" solid state physics (e.g., hysteresis effects in superconductivity) offers an equally wide choice of thesis topics. Modern and extensive technical facilities for the study of the structure and behavior of matter, under expert supervision, are at the disposal of the students who are urged to make full use of them. Among these facilities, which are operated by the Cornell Materials Science Center (see page 00) or by the Department of Engineering Physics and Materials Science, are general metallography, X-ray diffraction, electron microscopy, high temperature, high pressure, materials processing (including crystal growing), etc. These facilities and the research laboratories are located in Bard Hall, Thurston Hall, Rockefeller Hall, and the new Clark Hall of Sciences.

Current research in the Field includes the following:

Crystalline Imperfections: substructure, dislocation mechanics and motion, point defects and their interaction, radiation damage.

Electrical and Magnetic Behavior: superconductivity, NMR and ESR, magnetic domain wall motion, photoconductivity, laser, amorphous semiconductors, conduction in oxides.

High Pressure Studies: creep, diffusion, electrical properties, elastic constants.

High-Temperature Materials: structure and properties of pyrolytic graphite, of ceramic fiber composites, and of complex compounds.

Mechanical Behavior: crack formation and propagation, anelastic behavior, fatigue, solid solution strengthening, embrittlement of nuclear reactor materials.

Phase Transformations: solidification, precipitation in metallic and nonmetallic materials, crystal growth.

Surface Structure and Reactions: liquid-solid and solid-gas interfaces, thin films, crystal nucleation.

The Cornell Materials Science Center, with which most of the staff are connected, provides not only technical facilities, but also financial support for research. It also encourages interdisciplinary projects, seminars, and exchange of ideas. Research that crosses conventional boundaries is also furthered by many staff members belonging to more than one Field and by the wide range of minor subjects which are available to the students, e.g., mathematics, engineering physics, engineering mechanics, chemistry, structural engineering, space science, etc.

Graduates from any undergraduate physical science or engineering curriculum will be accepted provided they have demonstrated marked competence in the basic parts of their studies and show promise, in general, as graduate students.

Students who, at the time of admission, are lacking the prerequisites for the graduate courses recommended by the Field will be permitted to make up the deficiencies by taking undergraduate courses, while enrolled as graduate students. Special introductory courses may be offered if there is sufficient demand.

In addition to fellowships and teaching assistantships, a number of research assistantships on either a nine-month or twelve-month basis are available.

An illustrated brochure with more details about research possibilities and graduate programs in the Field of Materials Science and Engineering may be obtained by writing to the Field Representative, Materials Science and Engineering, Bard Hall.

Mathematics (Arts)

Faculty: R. P. Agnew, J. B. Ax, I. Berstein, S. U. Chase, C. J. Earle, J. Eells, R. H. Farrell, W. H. J. Fuchs, H. H. Gershenson, R. Greenblatt, L. Gross, C. S. Herz, P. J. Hilton, A. R. Jones, P. J. Kahn, H. Kesten, J. Kiefer, S. Kochen, G. R. Livesay, A. Nerode, P. Olum, L. E. Payne, G. S. Rinehart, J. B. Robertson, A. Rosenberg, G. E. Sacks, D. P. Sather, F. L. Spitzer, C. J. Stone, S. Wainger, R. J. Walker, H. Widom, J. A. Williamson, J. Wolfowitz.

Field Representative: P. Olum, 124 White Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Algebra 1, 2, 3, 4
Analysis 1, 2, 3, 4
Geometry 1, 2, 3, 4
Mathematics 1, 2, 4

Language requirements for the Master's degree: proficiency in French, German, or Russian immediately upon admission to candidacy.

Prerequisites for candidacy are a knowledge of advanced calculus (including both theoretical and applied points of view) and modern algebra.

Candidates for the Master's degree are expected to obtain some understanding of mathematical thought, ordinarily by taking about 24 hours of courses at the graduate level. Qualifications for the doctor's degree include a broad acquaintance with the basic subjects of present day mathematics plus a demonstration of ability to do research in one or more branches of mathematics.

A booklet entitled *Graduate Work in Mathematics at Cornell* may be obtained by writing to the Chairman, Department of Mathematics, White Hall. The booklet contains additional information about graduate work and research in mathematics for the entering graduate student.

Mechanical Engineering (Engin.)

Faculty: N. W. Abrahams, T. J. Baird, J. F. Barrows, J. F. Booker, A. H. Burr, B. J. Conta, D. Dropkin, G. B. DuBois, F. S. Erdman, H. N. Fairchild, B. Gebhart, R. L. Geer, G. R. Hanselman, H. N. McManus, Jr., F. Ocvirk, R. M. Phelan, F. J. Pierce, D. G. Shepherd, R. L. Wehe.

Field Representative: D. Dropkin, 214 Upson Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Engineering Drawing 1, 2, 3, 4
Machine Design 1, 2, 3, 4
Materials Processing 1, 2, 3, 4
Thermal Environment 1, 2, 3, 4
Thermal Power 1, 2, 3, 4
Thermal Processes 1, 2, 3, 4

As prerequisite for graduate study in Mechanical Engineering, the student should have the equivalent of the courses in his major subject that are required of undergraduates in Mechanical Engineering at Cornell. These courses are described in the *Announcement of Engineering Courses and Curricula*. Those lacking the full equivalent of this training may be required to take one or more of these undergraduate courses or to do assigned work to make up the deficiency.

There are four departments in the Sibley School of Mechanical Engineering. Graduate work is not confined to these specific departments although major and minor subjects tend to coincide with departmental titles. Appropriate minor subjects may be taken in other divisions of the University.

ENGINEERING DRAWING. Individual attention is available to students wishing to do research and development work in industrial applications and teaching.

MACHINE DESIGN. Unique instruction is offered in design and related subjects. The thesis and courses may be concentrated in one of the following three areas or may overlap them: (1) design and development of a new machine or component, (2) analysis of an existing machine or component, (3) experimental investigation to determine design data or performance. The department has its own laboratory for stress, vibration, and endurance testing of machine parts, and for the study of hydraulic and pneumatic controls. It is particularly well equipped for studies of lubrication phenomena in journal bearings, and for studies requiring use of an analog computer. Courses are offered on the subjects of conceptual design, automatic machinery, design for manufacture, advanced design analysis, mechanical design of turbomachinery, advanced kinematics, design problems in vibration and dynamics, industrial acoustics, automatic controls, automotive engineering, experimental methods related to design, and design of complex systems. Special interests of the staff include the lubrication and performance of bearings under high speeds and dynamic and misaligning loads, gearing, brake performance, vibration and impact stresses in machine parts, noise, endurance of shafts in machine assemblies, residual stresses, and hydraulic controls. Students who major or minor in machine design usually take their other work in engineering mechanics, materials, materials processing, control systems and servo-mechanisms, mathematics, thermal engineering, or industrial engineering.

MATERIALS PROCESSING. A general survey at the advanced level will serve as the foundation for work on individual problems dealing with the principal features and specific details of machine tools, cutting tools, machinability of materials, metal cutting theory and analysis, machine tool dynamometry, cutting tool wear, thermal aspects of machining, economics of chip formation processes, new processes of metal removal, work and tool holding devices, and gaging and inspecting methods. The laboratory provides modern and unique facilities for measuring performance and efficiency

of machines, tools, and accessories; testing and inspecting of equipment and parts; and experimental investigations of new methods.

THERMAL ENGINEERING. There are excellent opportunities for both analytical and experimental studies at the graduate level in thermal engineering. The approved major and minor subjects are in three areas of special interest to the staff. In thermal processes are included such studies as advanced thermodynamics, heat transfer, thermodynamics and fluid dynamics of compressible fluid flow, and combustion. Thermal power includes advanced studies in principles of turbomachinery, combustion engines, propulsion systems, nuclear power, direct energy conversion, and solar power. Thermal environment includes advanced studies in refrigeration, air conditioning, heat pumps, and the utilization of solar energy. In the laboratories of the School of Mechanical Engineering, a considerable amount of instrumentation and equipment is available for the study of thermal processes and performance of engineering components and systems. In addition to the customary instruments such as oscilloscopes, oscillographs, potentiometers, hot-wire anemometer, etc., the laboratory possesses a large Mach-Zehnder Interferometer of very high precision, a plasma arc generator capable of producing plasmas with high enthalpies and temperatures up to 25,000°F, and a solar collector apparatus suitable for thermal radiation studies. Several fans and compressors are available for a range of air flow, together with a gas-fired steam generating unit. By a choice of his minor subject or subjects, the thermal engineering major may study at an advanced level in basic sciences such as mathematics, physics, and chemistry, or in related engineering areas such as aerospace engineering, chemical engineering, electrical engineering, engineering mechanics and materials, engineering physics, and metallurgical engineering. Many courses are offered at an advanced level in the other departments of the School of Mechanical Engineering which may be combined to constitute a minor subject. The graduate student will ordinarily find it desirable to enroll in a number of the elective courses offered in the Department of Thermal Engineering, and he will be expected to participate in departmental seminars attended by students, staff, and visitors.

Nuclear Science and Engineering (Arts, Engin.)

Faculty: K. B. Cady, D. D. Clark, T. R. Cuykendall, D. Dropkin, D. E. Fisher, C. D. Gates, J. L. Gregg, J. P. Howe, S. Linke, R. M. Littauer, W. E. Meserve, M. Nelkin, R. L. Von Berg.

Field Representative: M. S. Nelkin, 116 Nuclear Reactor Laboratory.

APPROVED MAJOR AND MINOR SUBJECTS

Nuclear Engineering 1, 2, 4 Nuclear Science 1, 2

Graduate studies in this Field are intended to increase knowledge of subjects such as those listed below, and to provide training in the processes of acquiring knowledge through research.

Thesis research in Nuclear Science may be chosen from among the following subjects: activation analysis (quantitative measures by neutron-induced radioactivities); development of radiation detectors; low-energy nuclear physics and nuclear chemistry (decay schemes of radioactive nuclides, studies

of the fission process, low energy nuclear reactions); nuclear cosmochemistry (nuclear phenomena in cosmological settings, such as meteorites and satellites); radiation chemistry and radiation damage studies (effects of radiation on substances); radiochemistry (chemistry of radioactive substances); theory of neutron scattering, neutron transport theory.

Thesis research in nuclear engineering is intended not only to extend knowledge but to apply it to engineering objectives. Topics may be chosen from among the following subjects: basic processes in the transfer of heat and generation of power from nuclear reactions, chemo-nuclear processes, nuclear materials and fuels, reactor kinetics, reactor statics of slightly enriched water-moderated critical assemblies and subcritical assemblies, and selected problems in reactor design and optimization.

Research and devolpment connected with nuclear energy requires knowledge of a number of scientific and engineering disciplines. Thus the organization of the program permits and encourages this kind of interdisciplinary study, training, and research. The above major and minor subjects will not both be used by a student because either provides adequate flexibility and breadth, and both will be strengthened by appropriate selections of other minors. Work involving nuclear phenomena, radiation, isotope production, and the like will be done for the most part in the Nuclear Reactor Laboratory which was designed specifically for this purpose. At the present time, four faculty members and all graduate students in nuclear science and engineering work in this laboratory.

The Nuclear Reactor Laboratory was occupied in 1961 and contains: (1) a TRIGA reactor which may be operated steadily at 100 kw producing a neutron flux of 1 to 5 $\times$ 10^{12}/cm^2 sec. In addition, the reactor may be pulsed to a peak power of approximately 250 megawatts for the study of phenomena of fairly short duration. The width of the pulse at half maximum is approximately 40 millisec. Eight beam ports and a thermal column allow flexible use of neutrons and radiation. (2) A zero power reactor of versatile design for basic studies of reactor physics. (3) Subcritical assemblies for similar studies. (4) A shielded cell for chemo-nuclear work with up to 10,000 curie gamma sources and other radioactive materials. Accompanying laboratory space permits work with radioactive materials at low levels. A 3-mev 0 to 10 milliampere Cockroft Walton accelerator for studies of radiation effects and low energy nuclear levels and reactions has been in operation since 1964.

Students with an undergraduate major in either science or engineering will be admitted if they show a strong background in chemistry, physics, and mathematics.

Physics (Arts)

Faculty: V. Ambegaokar, L. L. Barnes, A. J. Bearden, K. Berkelman, H. A. Bethe, R. Bowers, P. A. Carruthers, D. G. Cassel, G. V. Chester, D. G. Clark, R. M. Cotts, J. P. Delvaille, J. W. DeWire, D. A. Edwards, D. B. Fitchen, C. W. Gartlein, L. Germer, T. Gold, K Gottfried, K. I. Greisen, F. L. Gross, L. N. Hand, P. L. Hartman, D. F. Holcomb, T. Kinoshita, J. A. Krumhansl, D. M. Lee, R. M. Littauer, H. Mahr, B. D. McDaniel, N. D. Mermin, M. S. Nelkin, H. F. Newhall, J. Orear, L. G. Parratt, T. J. Peterson, Jr., R. O. Pohl, T. H. Rhodin, H. Sack, E. E. Salpeter, A. J. Sievers, R. H. Silsbee, A. Silverman, R. L.

Sproull, P. C. Stein, R. M. Talman, W. Webb, D. H. White, J. W. Wilkins, K. G. Wilson, R. R. Wilson, G. J. Wolga, W. W. Woodward, D. R. Yennie.

Field Representative: R. M. Cotts, 5 Clark Hall of Science.

APPROVED MAJOR AND MINOR SUBJECTS

Biophysics 3, 4
Experimental Physics 1, 2, 3, 4
Physics 1, 2, 3, 4
Theoretical Physics 1, 2, 3, 4

Language requirement for the Master's degree: proficiency in French, German, Russian, or an approved substitute.

The major and both minor subjects for the doctorate may not all be chosen inside the Field of Physics.

The major subject for the doctorate may be experimental physics only if accompanied by theoretical physics as a minor, and may be theoretical physics only if accompanied by experimental physics as a minor.

The major subject for the Master's degree may be physics only if the minor subject is chosen outside the Field of Physics, or for the doctorate only if both minor subjects are chosen outside the Field of Physics.

The large majority of entering students have completed the equivalent of an undergraduate physics major program, including some junior-senior physics laboratory and an introduction to quantum mechanics. The student's background in mathematics should include some knowledge of differential and integral vector calculus, and applied analysis. He should have a reading proficiency in at least one of the following languages: French, German, or Russian. Training beyond the minimum in physics, mathematics, and foreign language allows the student to move ahead more rapidly.

In admitting students, however, the emphasis is on the quality of the undergraduate work and on the promise for graduate work rather than on the extent of undergraduate study in physics and in related subjects.

Typically a student enters as a candidate for the Master's degree. After one or two terms of satisfactory performance in graduate-level courses and in special examinations, he may transfer if he wishes to Ph.D. candidacy without completing the Master's degree. Most students so transfer.

A student whose academic background is either deficient or questionable may be admitted as a provisional candidate; this is fairly common for students from foreign countries.

Members of the staff are especially interested in directing graduate research in the following areas:

EXPERIMENTAL PHYSICS: High-energy nuclear and particle physics; atomic and solid state physics, cosmic rays; X-ray physics; optical and radio frequency spectroscopy.

THEORETICAL PHYSICS: Quantum mechanics; quantum theory of fields; theory of nuclei; fundamental particles; cosmic radiation; astrophysics; and the theory of the solid state.

Colloquia in general physics, and seminars in theoretical physics, solid state physics, and high-energy phenomena, meet regularly; and seminars in special fields meet as arranged.

A booklet entitled *Graduate Study in Physics at Cornell* can be obtained by writing to the Chairman, Department of Physics, Clark Hall of Science. The booklet contains additional information for the entering graduate student in physics.

Statistics (Ag., Arts, Engin., I.L.R.)

(See page 92.)

Theoretical and Applied Mechanics (Engin.)

Faculty: P. P. Bijlaard, H. D. Block, H. D. Conway, E. T. Cranch, H. H. Johnson, R. H. Lance, G. S. S. Ludford, T. P. Mitchell, J. P. Moran, J. R. Moynihan, Y. H. Pao.

Field Representative: R. H. Lance, 329 Thurston Hall.

APPROVED MAJOR AND MINOR SUBJECTS

Fluid Mechanics 1, 2, 3, 4
Solid Mechanics 1, 2, 3, 4
Mechanics of Materials 1, 2, 3, 4

The graduate program in mechanics and applied mathematics emphasizes fundamental understanding of the newest developments in engineering and applied science. Graduate students are exposed to the mechanics of liquids, gases, particles, rigid and deformable solids and related areas of materials, mathematics, and physics. The analytical nature of the studies encourages research that cuts across various fields.

Members of the faculty are particularly interested in directing research in the following areas:

CONTINUUM THEORY: Mathematical theory of elastic and inelastic materials.

OPTIMIZATION OF MECHANICAL SYSTEMS: Optimum design of structures, space vehicle trajectory analysis, and studies in optimum control.

SPACE MECHANICS: Trajectories and orbits of space vehicles and satellites, and the theory of thin-walled, light-weight structures used in space travel.

STRUCTURAL MECHANICS: The fundamentals of the dynamics and statics of structures including energy principles and buckling.

THEORETICAL FLUID MECHANICS: The dynamics of ideal and real fluids, especially magnetohydrodynamics.

VIBRATION THEORY: Free and forced vibration of linear and nonlinear mechanical and electrical systems having lumped or continuous properties with applications to mechanical and structural design.

WAVE PROPAGATION IN SOLIDS: The dynamic response of plates, structures, machine elements, and continuous media including applications to transient loading and dynamic stress concentration.

These interests produce close contact with and participation in the Center for Applied Mathematics and the Center for Radiophysics and Space Research.

Water Resources (Ag., Arts, Engin.)

Faculty: D. J. Allee, R. D. Black, L. B. Dworsky, A. W. Eipper, L. M. Falkson,

C. D. Gates, L. S. Hamilton, G. A. Kiersch, G. Levine, W. R. Lynn, D. A. Woolhiser, P. J. Zwerman.

Field Representative: C. D. Gates, 263 Hollister Hall.

APPROVED MINOR SUBJECT

Water Resources 4

This Field offers qualified engineers and scientists an opportunity to gain breadth of knowledge in the comprehensive aspects of water resources planning and management at the same time that they increase their depth of knowledge in their own disciplines. Study in the major subject is complemented by an integrated program of study in a minor subject designated as water resources and required of all candidates choosing this Field.

The water resources minor will represent for each candidate that combination of courses, including core courses, seminars, and projects outside his own discipline most likely in the judgment of his committee to meet his needs and interests in the comprehensive aspects of the program.

An applicant for admission as a candidate for an advanced degree with a minor in this Field must hold a Bachelor's degree in a biological, physical, or social science, or in engineering. A candidate planning work at the doctoral level should recognize the importance of water resources reference material in foreign languages and is strongly urged to prepare himself to meet the Graduate School language requirements as soon as possible.

Complementing major and minor subjects ordinarily will be chosen from the following list (Fields and faculty as shown):

Aerial Photographic Studies 2, 3, 4 (Civil Engineering): D. J. Belcher, T. Liang, G. B. Lyon, A. J. McNair.

Agricultural Policy and Economic Development 1, 2, 3, 4 (Agricultural Economics): D. J. Allee, H. Conklin.

American Government 1, 2, 3, 4 (Government): A. Altshuler.

Areal Geology 1, 2, 3, 4 (Geology and Geography): A. L. Bloom, W. S. Cole, G. A. Kiersch.

Chemical Engineering 1, 2, 3, 4 (Chemical Engineering): H. F. Wiegandt, C. C. Winding.

Econometrics and Economic Statistics 1, 2, 3, 4 (Economics): T. C. Liu.

Economic Development and Planning 1, 2, 3, 4 (Economics); J. Fei, C. Morse.

Economic Theory and Its History 1, 2, 3, 4 (Economics): L. M. Falkson, B. P. Stigum, J. Vanek.

Fishery Biology 1, 2, 3, 4 (Conservation): A. W. Eipper, J. L. Forney, H. A. Regier, D. A. Webster.

Hydraulics 1, 2, 3, 4 (Civil Engineering): W. H. Brutsaert, W. H. Graf, J. A. Liggett.

Hydraulic Engineering 2, 3, 4 (Civil Engineering): W. H. Brutsaert, W. H. Graf, J. A. Liggett.

Hydrogeology and Engineering Geology 1, 2, 3, 4 (Geology and Geography): G. A. Kiersch.

Limnology 1, 2, 3, 4 (Entomology and Limnology): C. O. Berg, D. J. Hall, J. M. Kingsbury.

Meteorology 1, 2, 3, 4 (Agronomy): B. E. Dethier.

Natural Resources Conservation 1, 2, 3, 4 (Conservation): L. S. Hamilton, G. A. Swanson.

Oceanography 1, 2, 3, 4 (Conservation): J. P. Barlow.
Operations Research 1, 2, 4 (Industrial Engineering and Operations Research): R. W. Conway, W. L. Maxwell, B. W. Saunders.
Physical Geography 1, 2, 3, 4 (Geology and Geography): A. L. Bloom.
Public Finance 1, 2, 3, 4 (Economics): R. W. Kilpatrick.
Regional Planning 1, 3, 4 (City and Regional Planning): J. C. Fisher, B. G. Jones, K. C. Parsons, J. W. Reps.
Sanitary Engineering 1, 2, 3, 4 (Civil Engineering): V. C. Behn, L. B. Dworsky, C. D. Gates, W. R. Lynn, D. A. Woolhiser.
Soil and Water Engineering 1, 3, 4 (Agricultural Engineering): R. D. Black, G. Levine.
Soils 1, 2, 3, 4 (Agronomy): N. C. Brady, M. G. Cline, G. R. Free, H. A. Kerr, R. D. Miller, E. L. Stone, P. J. Zwerman.

GRADUATE SCHOOL OF MEDICAL SCIENCES

The opportunity for graduate work leading to advanced general degrees was first offered in the Medical College in 1912 in cooperation with the Graduate School of Cornell University. In June 1950 the Sloan-Kettering Institute of Cancer Research, by approval of the trustees of Cornell University, became a graduate division of the Medical College, making possible the extension of graduate work into specialized areas of the basic biological and physical sciences. This expansion of the New York City component of the Graduate School resulted in the establishment in January 1952 of the Graduate School of Medical Sciences which, with the approval of the faculty of the Graduate School of Cornell University, was given the full responsibility for administrative matters related to the advanced general degrees granted for study in residence at the New York City campus of Cornell University.

The general degrees of Ph.D. and M.S. are awarded for advanced study and scholarly, independent research in the fields of anatomy, applied mathematics, biochemistry, biophysics, immunology, microbiology, pathology, pharmacology, physiology, preventative medicine, and public health.

The facilities for graduate work at the Graduate School of Medical Sciences include those of the Medical College and of the Sloan-Kettering Division. The five buildings of the Medical College extending along York Avenue from 68th to 70th Street in New York City contain the lecture rooms, student laboratories, library, and research facilities for graduate and undergraduate work. The Sloan-Kettering Division is located in the Sloan-Kettering Institute and the Kettering Laboratory on East 68th Street in New York City, and in the Walker Laboratory in Rye, New York. The special facilities and experienced investigators of the Sloan-Kettering Division offer ample opportunity for advanced graduate work in the basic science aspects of research related to cancer and allied diseases.

For full information regarding the graduate program of the Graduate School of Medical Sciences, the Announcement of this school should be consulted. Requests for this Announcement should be addressed to the Graduate School of Medical Sciences, Cornell University Medical College, New York, 10021.

ADVANCED PROFESSIONAL DEGREES

Advanced professional degrees are designed as preparation and training for a special profession. The admissions, requirements, and curricula for such degrees, as approved by the Graduate Faculty, are announced by the faculty of a professional school or college, which, for this purpose, acts as a Division of the Graduate Faculty. Degrees are awarded upon recom-

mendation of the Division to the Graduate Faculty.* Detailed information regarding admission or academic requirements for any professional degree is included in the Announcement of the separate school or college in which the degree is offered. Inquiries addressed to the Graduate School will be forwarded to the proper official. The professional degrees listed below are approved by the Graduate Faculty.

ARCHITECTURE, FINE ARTS, LANDSCAPE ARCHITECTURE, REGIONAL PLANNING

The following four degrees are administered by the Division of Architecture and Fine Arts of the Graduate School. Inquiries should be addressed to the listed professor.

For advanced degrees in architectural structures, architectural history, and art see the Humanities section of this Announcement.

The *Announcement of the College of Architecture* should be consulted for descriptions of the requirements for the following degrees:

MASTER OF ARCHITECTURE (M.Arch.). Training in urban design. Only graduates of a five-year professional program in architecture or graduates of a program in city planning or landscape architecture are admitted as candidates. (Professor C. F. Rowe.)

MASTER OF FINE ARTS (M.F.A.). Advanced training in the practice of painting or sculpture. (Professor J. O. Mahoney.)

MASTER OF LANDSCAPE ARCHITECTURE (M.L.A.). Advanced training in landscape design. (Will not be offered in 1966–67.)

MASTER OF REGIONAL PLANNING (M.R.P.). Training for a professional career in the fields of city planning or regional planning. (Professor K. C. Parsons.)

EDUCATION

The following three degrees are administered by the Division of Education of the Graduate School. The programs leading to each of the degrees include courses, seminars, projects, and investigations of an advanced or graduate nature which will develop the student's ability to

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* The following are advanced degrees which are also first degrees of a school or college and therefore are not subject to the jurisdiction of the Graduate Faculty. For information regarding them, address the school or college indicated.

Bachelor of Laws ..... Law School
Master of Engineering (Aerospace) ..... Graduate School of Aerospace Engineering
Master of Business Administration, Master of Public Administration ..... Graduate School of Business and Public Administration
Doctor of Medicine ..... Medical College, New York City
Doctor of Veterinary Medicine ..... Veterinary College

perform acceptably the professional duties required of the several types of educational specialization.

Fundamental differences between programs leading to professional degrees and those leading to general degrees include the manner of meeting the residence requirement, the emphasis on research, the specification of hours of credit required, the extent of dependence on meeting certification requirements, and the degree of restriction to major and minor subjects of study. For comparison of requirements for general and professional degrees as they affect programs, see pages 0–00 in this Announcement and see also the *Announcement of the School of Education.*

MASTER OF ARTS FOR TEACHERS (M.A.T.). The program is designed for persons who have at least provisional certification to teach, having had either student teaching or full-time teaching experience, and who wish to add to their qualifications in a teaching subject chosen from English, speech, mathematics, the social studies, and languages.

MASTER OF ARTS IN TEACHING (M.A. in T.). This program is designed for and limited to those preparing for teaching in elementary and secondary schools. The student and his Special Committee will select those courses and seminars in his teaching specialty and in education which are deemed most appropriate for developing competence as a teacher. He will be required to demonstrate his teaching skill in a supervised field experience.

DOCTOR OF EDUCATION (Ed.D.). The program for this degree is designed to prepare the candidate within a broad cultural context for positions of professional leadership in the Field of Education. The program of studies must include advanced work in each of the following: educational psychology, history or philosophy of education, educational measurement and statistics, and research in education. At least fifteen hours of credit must be earned in courses other than those in professional education. A minimum of 65 credit hours beyond the Bachelor's degree is required, of which 35 hours should be completed beyond the Master's degree or its equivalent. A year of directed field experience is required in addition to the requirement of study in residence.

The requirements for the completion of these professional degrees include a residence requirement. (See the *Announcement of the School of Education* for variation in this requirement among degrees.) Credit earned during candidacy for professional Master's degrees at Cornell or elsewhere may be transferred toward meeting the residence requirement for a doctoral degree in an amount not exceeding two units. The amount transferable is dependent upon an evaluation of the candidate's program and the manner in which the residence was earned.

Professional Teaching

MASTER OF SCIENCE FOR TEACHERS (M.S.T.). This is a coordinated program of training in the biological sciences, earth sciences,

and physical sciences for prospective and practicing teachers of the sciences. Each candidate must satisfy a broad core program in the sciences and complete advanced work in his selected study. This degree is administered by the Division of Professional Teaching of Graduate School. Detailed information may be obtained from the Graduate School.

ENGINEERING

The degree of Master of Engineering is administered by the Engineering Division of the Graduate School. Specially oriented graduate programs of study are in the areas of agricultural, chemical, civil, electrical, industrial, mechanical, metallurgical, and nuclear engineering, and in engineering physics. The following titles designate the professional Master's degrees offered in Engineering:

Master of Engineering (Agricultural)
Master of Engineering (Chemical)
Master of Engineering (Civil)
Master of Engineering (Electrical)
Master of Engineering (Engineering Physics)
Master of Engineering (Industrial)
Master of Engineering (Mechanical)
Master of Engineering (Metallurgical)
Master of Engineering (Nuclear)

The Announcement of *College of Engineering: Courses and Curricula* and the booklet *Graduate Study in Engineering at Cornell* should be consulted for complete descriptions of requirements for these degrees.

INDUSTRIAL AND LABOR RELATIONS

MASTER OF INDUSTRIAL AND LABOR RELATIONS (M.I.L.R.). The program leading to this degree provides a basic course of graduate study for those with professional interests in industrial and labor relations and further provides limited opportunities for specialized professional study where broad competence has been established. This degree is administered by the Division of Industrial and Labor Relations of the Graduate School. A detailed description of the program is found in the *Announcement of the School of Industrial and Labor Relations.*

LAW

The following two degrees are administered by the Division of Law of the Graduate School. The *Announcement of the Law School* should be consulted for a complete description of the program and requirements.

MASTER OF LAWS (LL.M.). This degree is intended primarily for a student who desires to increase his knowledge of the law by working in a specialized field.

DOCTOR OF THE SCIENCE OF LAW (J.S.D.). This degree is intended for a student who desires to become a proficient scholar by original investigation into the functions, administration, history, and progress of law.

MUSIC

DOCTOR OF MUSICAL ARTS (A.Mus.D.). This degree is appropriate for mature composers who seek further professional training as well as knowledge of the other arts and humanities, both to enrich their creative perspectives and to prepare them for composition teaching at the university level. It is administered by the Department of Music, acting as a Division of the Graduate School for this purpose.

NUTRITIONAL AND FOOD SCIENCE

The following two degrees are administered by the Division of Nutrition of the Graduate School.

The *Announcement of the Graduate School of Nutrition* should be consulted for complete descriptions of requirements.

MASTER OF NUTRITIONAL SCIENCE (M.N.S.). This program emphasizes fundamental study in the basic sciences that can lead to specialization in such fields as nutritional biochemistry, public health nutrition, human and clinical nutrition, and international nutrition. In addition, for candidates interested in the biological sciences, the program serves as a valuable preliminary for more advanced graduate study.

MASTER OF FOOD SCIENCE (M.F.S.). The fundamental sciences, chemistry, biochemistry, and bacteriology, that are involved in food processing and utilization, are emphasized. Electives are available to meet individual needs in engineering, economics, marketing, business administration, and international programs. The specialized training serves as a preparation for technical work as related to the food industry or for more advanced graduate study.

VETERINARY MEDICINE

DOCTOR OF SCIENCE IN VETERINARY MEDICINE (D.Sc. in V.M.). This degree is characterized by a professional rather than a general research objective, and it is designed especially for experienced persons in the basic and clinical sciences who need more specific, advanced, scientific, and professional knowledge in order to equip themselves for careers in teaching and research. This degree is administered by the Division of Veterinary Medicine of the Graduate School.

TUITION AND FEES

Tuition and fees* become due when the student registers. Any student who fails to pay his tuition charges, other fees, and other indebtedness to the University, or who, if entitled to free tuition, fails to claim it at the Treasurer's Office and to pay his other fees within the prescribed period of grace, will be dropped from the University unless the Treasurer has granted him an extension of time to complete payment. The Treasurer is permitted to grant such an extension when, in his judgment, the circumstances of a particular case warrant his doing so. For any such extension the student is charged a fee of $5. A reinstatement fee of $10 is assessed against any student who is permitted to continue or return to classes after being dropped from the University for default in payments. The assessment may be waived in any instance for reasons satisfactory to the Treasurer and the Registrar when such reasons are set forth in a written statement.

Students registering at any time during the last ten weeks of any term are required to pay tuition at the rate of 10 per cent of the regular tuition of the term for each week or fraction of a week between the day of registration and the last examination day of the term. Students registering at any time during the last five weeks in the short summer courses are required to pay tuition at the rate of 20 per cent of the term's tuition for each week or fraction of a week between the day of registration and the last examination day of the term.

Tuition or fees may be changed by the Trustees at any time without previous notice.

FEES PAYABLE BY GRADUATE STUDENTS

Registration Deposit

A deposit of $28 must be made by every applicant for admission after the applicant has received notice of acceptance, unless the candidate has previously matriculated as a student at Cornell University. This deposit is used at the time of first registration to pay the matriculation fee, chest X-ray, and examination-book charge, and covers certain expenses incidental to graduation if the student receives a degree. The deposit will not be refunded to any candidate who withdraws his application after May 22 or after 20 days of his admission approval. This fee is *not* covered by university fellowships, scholarships, or assistantships.

Tuition

Tuition is $200 a term for all students registered in the Graduate School whose major chairman is in the faculty of the state-supported divisions †

* All statements in this section are prepared by the Treasurer, who alone is authorized to interpret them.

† The state-supported divisions are the Veterinary College, the Colleges of Agriculture and Home Economics, and the School of Industrial and Labor Relations.

of the University. Those with major work in the School of Nutrition also pay $200 a term. Tuition in the Field of Education is generally $200 except in a few cases, where it is $735. All students in other divisions must pay tuition of $735 a term. Tuition is payable at the beginning of each term.

Upon recommendation by the appropriate college dean and by action of the Controller, for each appointment in a state-sponsored school or college, waiver of tuition in the Graduate School may be made to a member of the teaching or scientific staff, whose major field of study is in a state-supported school or college.

Assistants in state-supported schools or colleges on a twelve-month appointment who are registered for Summer Research for credit in the Graduate School may be recommended for waiver of tuition during the summer period under the above limitations. This waiver of tuition does not apply if the student registers in the Summer School or is not doing productive work for the department.

Any student who is to receive less than full residence because of his employment should apply for proration of tuition on forms procurable at the Graduate School Office. *Tuition is based on residence eligibility.* See pages 11–12.

General Fee

A fee of $187.50, payable at the beginning of each term, is required of each student registered in the Graduate School whose major chairman is on the faculty of one of the state-supported divisions,* or on the faculty of the School of Nutrition, or (in most cases) of the School of Education. All others pay a fee of $165. This General Fee contributes toward the services supplied by the libraries, Clinic and Hospital, and the student union in Willard Straight Hall, and pays a portion of the extra cost of laboratory courses and general administration.

A student who is regularly registered in the Graduate School for either one or both terms of the academic year and has paid the above fee is entitled to these services while in residence during the summer immediately following the academic year without payment of an additional General Fee. If such a student registers with the University during the summer, he is liable for payment of any tuition and other fees, and must present his ID card at the time of payment of these charges in order to claim exemption from payment of the General Fee.

A graduate student who returns to the University to present his thesis and to take the final examination for an advanced degree, all other

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* The state-supported divisions are the Veterinary College, the Colleges of Agriculture and Home Economics, and the School of Industrial and Labor Relations.

work for that degree having been previously completed, must register as a "Candidate for Degree Only" and pay a fee of $35.

Thesis Fee

Each doctoral candidate must pay $30 at the time of depositing the approved thesis and abstract in final form. This fee covers the cost of preparing a master microfilm of the entire thesis; of publishing the abstract in the bimonthly periodical, *Dissertation Abstracts;* of mailing the microfilm and abstract to the microfilm publisher; and of binding both copies of the thesis for deposit in the University Library.

Limited Refunds

Part of the tuition and General Fee will be refunded to students who officially withdraw during the first nine weeks of a term. A student arranges for withdrawal at the Graduate School Office. Students who withdraw are charged tuition and the General Fee at the rate of 10 per cent for each week or fraction of a week from registration to the effective date of withdrawal. No charge is made if the student withdraws within six days of registration. No part of the registration or matriculation fee is refundable.

Summer School

Graduate students who attend classes in the Summer Session must register both in the Graduate School and in the Summer Session; they must pay the tuition and fees listed in the *Announcement of the Summer School.*

Summer Research

Students registered for Summer Research pay one half of the General Fee for a registration period of not more than eight weeks and the full fee for a registration period of over eight weeks unless they were regularly registered in the Graduate School during the previous academic year. For those students eligible for and desiring residence, a prorated tuition is charged in accordance with the fraction of a residence unit to be earned, based on the tuition in effect for the subsequent academic term.

In Absentia

A graduate student registered *in absentia* will pay a fee of $35 each term. (See *Code of Legislation,* Pars. 84–85.)

GENERAL INFORMATION

ACTIVITIES FOR GRADUATE STUDENTS

There are places for graduate students in some extracurricular activities shared by undergraduates, such as intramural sports, drama, publications, music and the other arts, and additional areas of special interest. In the main, however, by reason of maturity and different interests, graduate students have their own organizations. More than 25 such organizations are connected with academic interests; some are purely social, others informally academic. Information on these organizations is available in the Office of the Dean of Students.

WILLARD STRAIGHT HALL AND THE SAGE GRADUATE CENTER provide facilities for graduate groups and aid in planning special functions for them.

CORNELL UNITED RELIGIOUS WORK (CURW) includes a range of activities for graduate students. Its offices are in Anabel Taylor Hall, which serves as the headquarters for chaplains who represent several denominations and who may be consulted by students.

SAGE CHAPEL, where nonsectarian services each Sunday are led by distinguished guest speakers, is maintained by the University. Graduate students are eligible for its trained choir.

CORNELL'S LOCATION in the Finger Lakes region of New York State stimulates outdoor activity. Agencies of the University operate outdoor swimming facilities, a golf course, a ski run with ski tow (twelve miles from the campus), riding classes, and other outdoor facilities. There are three large state parks within ten miles of the campus. Departments of the University plan field trips for various purposes, including ornithological, geological, agricultural, and industrial, which are open to interested graduate students.

COUNSELING

The University maintains a variety of counseling services available to graduate students. The primary academic counselors are the members of the Special Committee. Other counselors who are able to help in matters of various kinds will be found in the Office of the Dean of Students, the Office of Scholarships and Financial Aid, the International Student Office, the Gannett Medical Clinic, and the Sage Graduate Center.

FOREIGN STUDENTS

The University maintains an International Student Office, and students from abroad are invited to consult the staff about any problems they

may have. Foreign students should report to the International Student Office, 142 Day Hall, when they arrive at Cornell.

Applications and all necessary credentials for admission should be filed by foreign students several months before registration days (see pages 6 ff.). No student should apply who has not mastered colloquial English.

Before applying, a student from another country should be certain that he has sufficient funds in dollars to meet all necessary expenses, as cited in the brochure *Prospective Graduate Students from Outside the United States.* He should also make arrangements for additional help in the event of protracted illness or other emergency. *Students from foreign countries whose native language is not English or whose preparation differs from that of citizens of the United States should not expect to receive their degrees at the end of the minimum residence period.* Moreover, agencies subsidizing such students should be prepared to support them for a longer period. Such students are usually unable to qualify for assistantships or for other appointments yielding financial assistance during the first year of residence. Within these limits, Cornell University welcomes students from other countries.

HEALTH REQUIREMENTS ON ENTRANCE

The following health requirements for entering graduate students have been adopted by the Board of Trustees of Cornell University. Failure to fulfill these requirements may result in loss of privilege of registering the following term. The responsibility for fulfilling these requirements rests upon the student.

IMMUNIZATION. A satisfactory certificate of immunization against smallpox, on the form supplied by the University, must be submitted before registration. It will be accepted as satisfactory only if it certifies that within the last three years a successful vaccination has been performed. If this requirement cannot be fulfilled by the student's home physician, opportunity for immunization will be offered by the Cornell medical staff during the student's first semester, with the cost to be borne by the student. If a student has been absent from the University for more than three years, immunity will be considered to have lapsed and a certificate of revaccination must be submitted.

HEALTH HISTORY. Students accepted for admission will be required to submit health histories on forms supplied by the University.

X-RAY. Every student is required to have a chest X-ray. He may present a chest film made by a private physician on or before entering Cornell, provided that it was obtained within six months of initial registration and is of acceptable quality; *or* he may present a chest X-ray report, provided that the radiograph was taken within six months of initial registration, contains name and address of the X-ray facility, and is signed by a radiologist; *or* he may have a chest X-ray at Cornell during the orien-

A winter landscape is a common sight to graduate students in Ithaca.

tation period or at some other specified time shortly thereafter. The charge for the chest X-ray is included in the registration deposit.

When a student who has been away from the University for more than a year wishes to re-enter, he must, at his own expense, once more fufill the chest X-ray requirement, and he must also submit a new health history.

Failure to fulfill these requirements will result in a recommendation to the Registrar that the student be denied the privilege of registering the following term.

HEALTH SERVICES AND MEDICAL CARE

Health services and medical care for students are centered in two Cornell facilities: the Gannett Medical Clinic (out-patient department) and the Sage Hospital. Students are entitled to unlimited visits at the Clinic. (Appointments with individual doctors at the Clinic may be made by calling or coming in person; an acutely ill student will be seen promptly whether he has an appointment or not.) Students are also entitled to laboratory and X-ray examinations indicated for diagnosis and treatment; hospitalization in the Sage Hospital with medical care for a maximum of fourteen days each term and emergency surgical care. The cost of these services is covered in the General Fee.

On a voluntary basis, insurance is available to supplement the services provided by the General Fee. For further details, including charges for special services, see the *Announcement of General Information.* If, in the opinion of the University authorities, the student's health makes it unwise for him to remain in the University, he may be required to withdraw.

If a student prefers to consult a private physician rather than go to the Clinic, or to have the services of a private doctor while a patient in the Hospital, he must bear the cost of these services.

LIVING ARRANGEMENTS

DORMITORY ACCOMMODATIONS. — The University has established Sage Hall as a graduate residential center. Its dormitory facilities accommodate approximately 100 men in the north side of the building and 105 women in the south side. The Graduate Center, which is available for use by all graduate students and faculty, also contains a cafeteria seating 200, study rooms, and lounges. In addition, Cascadilla Hall has been newly remodeled to accommodate approximately 140 single graduate men.

Applications for dormitory accommodations may be made any time after January 1 for the coming academic year by writing the Department of Housing and Dining Services, 223 Day Hall.

FAMILY ACCOMMODATIONS. — The University, through the Department of Housing and Dining Services, has three apartment developments for married students and their families. They are Cornell Quarters, Pleasant Grove Apartments, and Hasbrouck Apartments, with total housing for about 400 families. All apartments are unfurnished. For further information and application, write the Department of Housing and Dining Services, Room 223, Day Hall.

The Department of Housing and Dining Services also maintains a list of available rental housing in the Ithaca area. Information on housing currently available can be obtained only at the Off-Campus Housing Office, Room 223, Day Hall. Lists cannot be sent out because changes occur daily. Students desiring off-campus housing should come to Ithaca well in advance of the term opening to arrange for such accommodations.

MILITARY SCIENCE AND AEROSPACE STUDIES (AFROTC)

The advanced course in military science (Army ROTC) and aerospace studies (Air Force ROTC) is open to graduate students who have satisfactorily completed a basic course in ROTC or who enroll in the two-year ROTC program. Successful completion of the two-year advanced ROTC course will qualify a graduate student for appointment as a Second Lieutenant in the U.S. Army or Air Force Reserve, or in the Regular Army or Air Force. Interested graduate students should consult the *Announcement of Officer Education* and apply to the Professor of Military Science or Professor of Aerospace Studies (ROTC), Barton Hall.

MOTOR VEHICLE REGISTRATION AND FEES

Vehicles include motorcycles, motorbikes, and motorscooters. Every student who owns, maintains, or for his own benefit operates a motor vehicle in Tompkins County during the time the University is in session, must register such vehicle with the Safety Division Office, even though such vehicle may be also registered by faculty, officers, or employees. All students must register motor vehicles within the prescribed time for University registration at the beginning of the fall term. Students who are not then subject to this rule but later become subject thereto, shall register such vehicles within 48 hours after becoming so subject. (Students entering the University for the spring semester, summer session, or re-entering after a period of absence must register motor vehicles with the Safety Division at the time of, or within the time for, general registration.) Students who have motor vehicles must comply with the following requirements: (1) the student must be legally qualified to operate a motor vehicle in New York State; (2) the vehicle must be registered in New York State or legally qualified to be operated on the highways of New York State, (3) all motor vehicles must be effectively insured against public liability for personal injury and property damage for the minimum of $10,000–$20,000–$5,000 for the duration of such

registration and while the vehicle is under the control of the registering student, (4) a registration fee covering the fall and spring terms or any part thereof shall be $4 and the fee for summer session shall be $1. The registration fee will be due and payable in the Treasurer's Office on the same date as tuition and other fees, and in the case of late registrants, within a week after such registration. A fine of $10 is levied if the vehicle is not registered within the specified time.

Suspension of the privilege of operating a motor vehicle may be enforced by requiring the student to deposit his registration plates and certificate and his driver's license with the Safety Division of the University during the period of such suspension. Refusal to comply with such a request may result in the student's suspension from the University.

STUDENT PARKING ON CAMPUS. Students *may not* park on campus from 8 a.m. to 5 p.m. Monday through Friday, and from 8 a.m. to 1 p.m., Saturdays. Restrictions applying to "No Parking" zones, dormitory parking areas, and areas listed as limited to holders of F-1 and F-2 permits are in effect 24 hours a day.

Special area parking permits are issued only after careful consideration by the Office of the Safety Division. Extenuating circumstances (physical disabilities, etc.) are the basis for the issuance of these permits.

The student's registration in the University is held to constitute an agreement on his part that he will abide by its rules and regulations with regard to traffic and parking, or suffer the penalty prescribed for any violation of them.

Correspondence regarding motor vehicles should be addressed to the Safety Division, G2 Barton Hall.

PLACEMENT

The University Placement Service makes arrangements for interviews on or off campus with employers, supervises the assembling and presentation of personnel records, and assists Cornell men and women who are ready for positions in business, industry, government, and other institutions. Graduate students are advised to register with the office approximately a year before they will be available for employment. The Educational Placement Service performs a similar function for those whose vocation is teaching. Many of the professional schools and colleges maintain separate placement offices for the special professions; their services are available to registered graduate students and alumni.

The University expects that all graduate students at Cornell University shall, at all times, act with a mature and morally responsible attitude, recognizing the basic rules of society and the common rights of others.

Index of Fields of Instruction and Approved Subjects

General Index